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15 July 1985

# USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

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# USSR REPORT

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## COMMUNICATIONS

UDC 656.25-52

### DEVELOPMENT OF DATA TRANSMISSION SYSTEM

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85,  
pp 7-9

ROMANENOK, V.K., Chief engineer of Computing Center of Belorussian Road

[Abstract] This paper is in the section "Automated Control System of Belorussian Road" of the journal. The principal stages of development of the automatic control system are described from teletype links to a fully computerized data transmission system with real time user dialogue interaction first using Minsk-1560 multiplexer with Akkord-1200 data transmitters for hook-up to YeS computers over the telegraph channels and then over telephone connections. It was possible to reduce the staff at the computer center to one telegrapher while increasing transmission speed and data reliability. In 1978 perforated tape was replaced by magnetic tape using the YeS9002 input unit and the final form of the system has YeS8401 multiplexers feeding into third generation YeS1035 computers. The RR system links to other ministries and departments and Ministry of Communication teleprinters are installed at stations for link-up to clients. A block diagram of the final form of the fully computerized system of data transmission is presented. Figures 1.

UDC 681.325:656.2

### CONNECTION OF YeS9004 DEVICE TO INTERFACE OF FS-1501 PHOTOREADER

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85 pp 26-28

ANISKEVICH, O., and KUCHMEL', G.

[Abstract] This paper is in the section "Automated Control System of Belorussian Road--Basic Technical Development" of the above journal. Persons involved in such development are identified at the beginning of the section and the nature of their work is shown. Punched tape was previously used as information carrier but is unreliable and develops malfunctions. At present



a device for preparation of data, the YeS9004, is widely used where the data is on magnetic tape. Connection of the YeS9004 to an electronic computer instead of a photoreader makes it possible to eliminate punched tape without requiring any adaptation of the program. The arrangement for connection of the YeS9004 to the interface instead of the FS-1501 photoreader [FS in Latin alphabet] is described. The YeS9004 performs data preparation and can read-out data from magnetic tape and transmit it to the interface. It can be connected to any device or electronic computer which has an interface for a FS-1501 photoreader. The method of operation is explained with the use of a two-page figure. Figures 2.

#### ORGANIZATION OF COMMON MEMORY FOR Minsk-32 AND YeS1035 COMPUTERS

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85 pp 28-29

KOZLOV, V.

[Abstract] This paper is in the section "Automated Control System of Belorussian Road--Basic Technical Development" of the journal. Persons involved in such development are identified at the beginning of the section and the nature of their work is shown. Introduction into the computing center of the Belorussian RR of electronic computers of the unified system (YeS) series required the organization of complexes of Minsk-32 and YeS machines because Minsk-32 units were still in use. A commutator was developed for this complex (Fig. 1) which can connect the different model computers into a system, the operation of which is explained. Processing carried out by the Minsk-32 used the same YeS magnetic disks as the YeS1035 units so that the complex developed earlier of two Minsk-32 units could be used compatibly with the YeS units. Four YeS1035 and three Minsk-32 electronic computers are linked in two groups at the Belorussian RR computer and apportion teleprocessing and other tasks by means of the compatible memory units. The system is unsatisfactory because failure of one unit puts the complex out of action. A new system is being developed (Fig. 4) consisting only of YeS units. A commutation switch is being developed which will make it possible to combine in a system any two YeS1035 electronic computers of the four in operation on a selector channel making use of YeS5061 magnetic disk memory.

#### MODEL OF RR LOCOMOTIVE OPERATION

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85, p 29

LEN'KO, O.F., senior engineer-mathematician

[Abstract] RR locomotive behavior was modelled in a data processing system in order to give the RR administration staff functional data on the locations and state of the available locomotives. A solution of this problem is presented based on data such as locomotive movements through RR junctions,

stations and control points and the repair of freight locomotives. Files are formed on magnetic disks with a capacity of 29 Mbyte. Each record of these files contains information concerning 12 sequential states of locomotives. On-line interrogations of these states is possible and answers to questions as to locomotive use and operation can be obtained in conversational mode.

UDC 681.327.8:658.012.011.56

#### ORGANIZATION OF DATA TRANSMISSION NETWORK OF BELORUSSIAN RR

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85, pp 9-11

SEMENYUTA, N.F., acting professor, Belorussian Institute of Railway Transport Engineers (BeliISHTa), candidate of technical sciences

[Abstract] This paper is included in the section "Automated Control System of Belorussian Road" in the above journal. The paper describes in detail the organization and history of the data transmission network (DTN), a component of the automatic control system (ACS) of the road, on the reliability of which the uninterrupted action of the ACS depends to a considerable degree. A secondary communication network used in the DTN is explained. This is an automatically switched telegraph and telephone network with channel switching which assures, respectively, low (50 bits/s) or average (600 or 1200 bits/sec) speeds. An increase is being considered of the speed of data transmission with respect to audio frequency channels up to 2400 bit/s which also will make it possible to reduce the load on the data transmission network. Figures 3.

UDC 681.3.01:656.2

#### SOFTWARE OF DATA PROCESSING SYSTEM

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85, pp 12-13

DOLMATOVICH, VIKTOR VASIL'YEVICH, chief, Department of Economic-Mathematical Calculations Programming, and TOCHILIN, M.N., deputy chief of Department

[Abstract] This paper is included in the section "Automated Control System of Belorussian Road" in the above journal and gives a detailed description of the software of a data processing system. In the description, a number of items are identified with the use of the English alphabet, e.g., MVT, VTS, SAD. An insert to this paper presents a photograph of Dolmatovich and a woman, Ol'ga Fedorovna Len'ko, both of whom worked for ten years in the Computing Center. M.N. Tochilin, the coauthor of the paper, is not mentioned. According to the insert, Dolmatovich directed the development of a system for computer responses to requests of users involved in the creation of an automated data processing system. Len'ko's work included study with

a computer of freight paperwork and a locomotive model. Both individuals have been decorated with the medal "Shock Worker of the 10th Five-Year Plan." A second insert gives a number of instances, showing the effect of computing technology on the qualitative and quantitative work indices of the Belorussian road. In the first half year of 1984, for example, the loading plan was fulfilled by 101.6%. At present the electronic computer at the RR computing center produces approximately 2,000 different solutions. Processing of trains at the stations of the road with the aid of working documents issued by the computer made it possible to accelerate breaking up and forming of trains by 5%. Because of the liquidation of stations for writing off of railroad cars, more than 200 persons were released. Figures 1.

UDC 681.3.01:656.2

#### DATA PROCESSING SYSTEM COMMUNICATION EQUIPMENT

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85, pp 14-15

ANISKEVICH, O.F. and KUCHMEL', G.N.

[Abstract] This paper is included in the section "Automated Control System of Belorussian Road--Basic Technical Development" in the above journal. Persons involved in such development are identified at the beginning of the section and the nature of their work is shown. The paper describes the communication link for a data processing system developed in the Department of Stationary and Linear-Cable Devices under the supervision of Aniskevich, chief of the department. A block diagram and an explanation of the complex are given for real time (or close to real time) interaction between clients and computers. Using RR experience with Minsk-32 computers and Minsk-1560 multiplexers a system was developed for YeS series computers using the already existing data transmission links. Data concentration and transmission points for RR data were equipped with teletypes and Akkord-1200 transmission units while YeS8401 multiplexers accessed the computers. The state of the multiplex links can be monitored from a special terminal. Figures 1.

UDC 681.327.8:656.2

#### AUTOMATIC SWITCHBOARD FOR 4-WIRE TELEPHONE CHANNELS 32 x 14

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 83, pp 15-21

ANISKEVICH, O., VOLKOVICH, A., and ZHUK, A.

[Abstract] This paper is included in the section "Automatic Control System of Belorussian Road--Basic Technical Development" of the above journal. Persons involved in such development are identified at the beginning of the section and the nature of their work is shown. The data transmission network

of the Belorussian road is described. It was constructed on the base of the Akkord-1200PP data transfer equipment, and the subscriber points TAP-3, operating with 4-wire separated telephone channels. The network connects to TETA-1220 error protection devices and YeS8401 multiplexers link to YeS1035 computers through an automatic switchboard with four-wire channels. This switchboard was developed and introduced in the computer center of the Belorussian RR and assures automatic connection of 32 channels with 14 devices for protection from error. The equipment for four subscribers can be connected to each channel. For an outgoing connection to the required subscriber one of 4 combinations of voice frequency must be selected. The channel to the subscriber equipment is switched with the assistance of a receiver with audio selective capacity. The switchboard operates in automatic (during incoming connections) and semiautomatic (during outgoing connections) regimes. Its principal switching element is a 20 x 10 x 6 cross-bar switch. A block diagram and a description are given for each of the following basic units included in the automatic switchboard: 1) Block of cross-bar switches; 2) Control desk; 3) Holding magnetic control unit; 4) Block for control of magnet selection; Generator block. Also included in the automatic switchboard are UPTI and UPTII current amplifiers. Figures 5; tables 1; photographs 2.

#### AUTOMATIC SHIFT OF OPERATING SPEEDS OF ADAPTERS OF YeS8401 MULTIPLEXER AND F1100 TELEPRINTERS

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85, pp 22-23

ANISKEVICH, O., and KUCHMEL', G.

[Abstract] This paper is included in the section "Automated Control System of the Belorussian Road--Basic Technical Development" in the above journal. Persons involved in such development are identified at the beginning of the section and the nature of their work is shown. It is shown here that jumpers in the YeS8401 multiplexers, operating with telegraph switch lines, switch OTRM50 (speed 50 baud) and OTRM100 (speed 100 baud) signals at a frequency which determines the transmission rate at each linear adapter. A circuit in which switching of these signals for 16 linear adapters is accomplished by electronic switches is illustrated and explained. A circuit for automatic shift of the speed of F1100 electronic teleprinters is also described. Figures 3.

## SUPPLEMENTARY INTERFACE TAP-34 WITH SWITCHABLE TELEGRAPH LINES

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85, pp 23-25

ZHUK, A.

[Abstract] This paper is included in the section "Automated Control System of Belorussian Road--Basic Technical Development" of the above journal. Persons involved in such development are identified at the beginning of the section and the nature of their work is shown. The TAP-34 subscriber's station (produced in Hungary) makes it possible to exchange data arrays over a single medium-speed telephone channel and the programming of the interface of the TAP-34 also makes it possible to receive and transmit data on a switchable telegraph line. The interface fulfills the following functions: analysis of readiness of telegraph station for selection of a number; automatic selection of a number, request for information and identification of answer-back of subscriber data, reception and transmission with a speed of 50 baud, as well as a display of errors. In interrupt mode it is possible to simultaneously operate the telegraph interface along with basic user program with data reception and transmission on a telephone link. A block diagram of the interface and a description of its components are presented. Figures 1.

## INTERFACING OF "AKKORD-1200" APPARATUS WITH DZM-18 PRINTER

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 1, Jan 85, p 25

YEROKHOVETS, B. and KUCHMEL', G.

[Abstract] This paper is included in the section "Automated Control System of Belorussian Road--Basic Technical Development" of the above journal. Persons involved in such development are identified at the beginning of the section and the nature of their work is shown. When delivering computer results to users, the data is transmitted to a PL-150 perforator and the punched tape is then printed out by a teleprinter. Connection of the DZM-180 mosaic printer to the Akkord-1200 data transmission system makes it possible considerably to simplify and to speed up the process of data delivery. The connections for the interface are shown in a block diagram. Because either the DZM180 mosaic printer or the PL-150 perforator can be connected to the Akkord-1200 data transfer apparatus, it is possible to develop a circuit for simultaneous reception of data in either perforated or printed form. Figures 2.

SPEEDING UP OF SCIENTIFIC-TECHNICAL PROGRESS -- BASIS OF SUCCESSFUL DEVELOPMENT OF "COMMUNICATIONS" SECTOR

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 pp 1-4

KUDRYAVTSEV, G.G., First Deputy Minister of Communications, USSR

[Abstract] This paper contains quite detailed statements on the progress already made by the USSR Ministry of Communications in the 11th Five-Year Plan, and on plans for the future. Various shortcomings in the work of the Ministry are also considered. An economic experiment which has been in progress since 1983 in the Ministries of Communications of the Belorussian and Latvia SSR is briefly described.

UDC 621.315.212

WAYS TO INCREASE EFFECTIVENESS OF MAINLINE TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 18 March 84) pp 5-7

KIM, L.T.

[Abstract] As a matter for discussion the paper considers the possibility of an increase of the technical and economic effectiveness of mainline analog and digital transmission systems which enter into a number of units of the country's electrical communication networks. Some existing and under development systems are described. These include the K-3600 and K-1920P analog transmission systems which today are the basis of development of the mainline primary network of the unified automated network of the Soviet Union. Constructed more than 10 years ago, these systems already do not completely fulfill contemporary requirements with respect to the degree of industrialization of construction of transmission lines and automation of the operating service and the radioelectronic elements have aged. As replacements, work is proceeding on a new family of mainline analog transmission systems as a part of the K-5400 and K-10800 systems. These systems are briefly described. Realized with contemporary technology they answer the requirements of the unified automated network of the Soviet Union and the recommendations of the International Telegraph and Telephone Consultative Committee. A detailed account is given of ways to increase the technical and economic effectiveness of transmission systems. It is concluded that on the mainline networks analog transmission systems will be utilized for at least 10-15 years, which will assure the most effective use of coaxial mainlines and during this period their production will remain at a high level. In order to satisfy requirements for transmission of the large digital load it is necessary to employ digital transmission systems. The main possibility for increasing the technical and economic effectiveness of mainline transmission systems is conversion to optical cable. One of the most important conditions for introduction of optical cable communication

systems into the mainline network is the availability of autonomous sources of power supply. Research on computerized processing and transmission of signals, as well as for operation of transmission systems is recommended. Tables 1; references 4: 1 Russian, 3 Western.

UDC 621.395.34

#### DETERMINATION OF ADDITIONAL NUMBER OF LINES IN OVERLOADED BUNDLES

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 20 Feb 84)  
pp 20-25

SHKOL'NYY, Ye.I., NAUMOVA, Ye. O., and KARKEVICH, A.D.

[Abstract] A method is proposed for calculation of the additional number of lines in an overloaded bundle of lines with repeated calls. The following items are examined: 1) Description of model; 2) Basic problems regarding the precision of measurements; 3) Statistical evaluation of characteristics; 4) Determination of the number of lines with allowance made for precision of measurements; 5) Measurement of intensity of flow of primary calls; 6) Determination of number of lines with allowance made for precision of measurements; and 7) Effect of measurements of model parameters on results of calculations. Figures 4; tables 2; references: 9 Russian.

UDC 621.395.74

#### CONSTRUCTION ALGORITHM FOR INTRAZONE PRIMARY NETWORK

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 10 Oct 82)  
pp 25-27

GIL'CHENOK, L.Z.

[Abstract] A construction algorithm for an intrazone primary network (IPN) is proposed, which makes it possible to minimize expenditures on line structures during organization of two independent routes from each point of the network to IPN line-operated unit one and one route to IPN line-operated unit two. Initial data necessary in order to solve the problem with the aid of the developed algorithm are described. A detailed description of the algorithm and an example of its use are presented. Figures 1; tables 1; references: 3 Russian.

## EQUIPMENT FOR OPERATIONAL AND STATISTICAL CONTROL OF TELEGRAPH SWITCHING STATIONS

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 27 Sept 83) pp 37-40

GUPMAN, P.E., ZAMARAYEV, V.P., KLUBAKOV, V.Ya. and PLYUSNIN, N.A.

[Abstract] The Kiev branch of the Central Scientific-Research Institute of Communications (TsNIIS) and the Sverdlovsk branch of the Central Design Bureau Office developed equipment for operational and statistical control of telegraph switching stations (POISK). This makes it possible, automatically, by means of a large series of control connections, to determine the quality of operation of stations and to check the most important parameters of the equipment. The principal functional devices of the POISK equipment are fulfilled with the use of series K155 microcircuits. The economic effect from the introduction of one equipment complex amounts to 7.2 thousand rubles a year. The general characteristics of the equipment, the principles of its operation, and its construction are considered. A block diagram and photographs of the equipment are presented. Figures 4; references 4 Russian.

## APPROACH TO STRUCTURAL SYNTHESIS OF CENTERS FOR SWITCHING OF MESSAGES

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 6 June 83) pp 41-44

KANAYAN, S.N., MARTIROSYAN, V.A., MATEVOSYAN, K.A. and ROSTOMYAN, D.K.

[Abstract] A method for synthesis of the structure of the technical facilities of centers for switching of messages (CSM) is offered, as well as estimates of the permissible limits of change of the parameters of the incoming flow, within which range the CSM maintains fitness for operation and fulfills its function with the required quality. Detailed consideration is given to the following items: 1) Analysis of the effect of varying conditions of operation of the CSM on its indices; 2) Estimate of upper limit of storage capacity of CSM; and 3) Synthesis of CSM structure. Tables 2; references: 4 Russian.



## COMPLEX OF APPARATUS FOR REMOTE CONTROL OF EQUIPMENT OF RECEIVING AND TRANSMITTING CENTERS FOR SHORTWAVE RADIO COMMUNICATIONS

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 29 March 84) pp 45-47

YAKHNIN, V.G., FRANTSEV, E.P., LOZINSKIY, V.M. and SHNYREV, Ye.F.

[Abstract] The paper describes a complex of ADU-2 equipment, production of which will significantly be increased with the object of a change to a regime of telecontrol of radio centers, equipped with automatized equipment. This makes it possible to use completely the possibilities of automatized equipment and to obtain the proper economic effect. Two modifications of the equipment complex will be made: for transmitting and for receiving radio centers. The following items are considered in detail: 1) Basic functions fulfilled by complex; 2) Complex for transmitting radio centers; and 3) Modification of complex of receiving center. Components of the complex underwent experimental exploitation at radio centers of the USSR Ministry of Communications and showed a sufficiently high reliability in operation, as well as convenience of servicing. Figures 2; tables 2; references: 2 Russian.

## NOISE IMMUNITY AND EFFICIENCY OF BROAD BAND RADIOTELEPHONE CELLULAR SYSTEM OF MOBILE COMMUNICATION

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 27 June 83) pp 48-52

VARAKIN, L.Ye.

[Abstract] The paper reviews a number of published articles concerned with the cellular system of mobile communication (CSMC), used at present for radio communication between moving objects and telephone subscribers in large cities and territories, especially in the U.S. and Japan. Mutual interference is considered and particular attention is given to the noise immunity and efficiency of the CSMC, including the advisable use of a noise suppression signal. Figures 2; tables 5; references 12: 7 Russian, 5 Western.

## NOISE IMMUNITY AND POTENTIAL VALUE OF RADIO CIRCUIT FOR INFORMATION TRANSMISSION WITH REPEATER

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 6 May 83)  
pp 34-36

TETERIN, A.R.

[Abstract] Two types of operation of repeaters occur in satellite communication systems with active relaying. The first is a regime of direct relaying (DR) where by means of equipment aboard the satellite, an increase of the signal and a transfer of it to another carrier frequency is accomplished. The second is a regime of processing signals on board (PSB). The energy gain during transition from DR to PSB and the potential value of a radio line with a repeater which has one-way transmission are considered. Relationships are obtained which make it possible, even at the initial stages of design, to evaluate the potential value of radio lines with repeaters for DR and PSD, to compare these regimes with respect to the energy factors and costs, and to determine, in the limits of the statement of the problem, the optimum values of the power parameters of the radio line. References: 2 Russian.

UDC: 621.391

## INVESTIGATION OF POSSIBILITIES OF ENHANCING EFFECTIVENESS OF SIGNAL NORMALIZATION BY INTERFERENCE LEVEL AT OUTPUT OF INTER-PERIOD PROCESSING SYSTEMS WITH SMALL SAMPLES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 14 Feb 84) pp 19-25

KOSHEVOY, V.M. and TARABUYEV, S.T.

[Abstract] This study investigates the possibility of improving the effectiveness of single normalization by interference level with small learning samples by exploiting the information contained in the independent samples of the signals received from a number of range resolution elements, as well as correlated samples received from each range resolution element during different repetition periods of the sounding pulses. The margin for improvement of normalization effectiveness for steady-state interference is estimated. A normalization algorithm, employing maximum-likelihood estimation of the variance at the output of a processing system with known interference correlation matrix is investigated. It is found that the false alarm and correct detection probabilities can be a strong function of the correlation properties of the interference in processing systems employing noncoherent accumulation. References 10: 8 Russian, 2 Western.

[204-6900]

## PERIODIC PHASE-SHIFT KEYED LOCALLY OPTIMAL SIGNALS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 28, No 1, Jan 85 (manuscript received 26 Jan 84) pp 25-31

MITSEL'MAGER. E.Ye.

[Abstract] A necessary and sufficient condition is formulated for local optimality of signals, which are defined as signals that provide the lowest possible periodic autocorrelation function in some delay interval. A regular method is developed for synthesizing locally optimal signals with unrestricted numbers of samples and nulls of the autocorrelation function in the region equal to half of all of the signal time delays. The possibility of synthesizing two locally optimal signals such that their combined optimality intervals include the entire time delay domain is discussed. Application of locally optimal signals is discussed. References 4 Russian.  
[204-6900]

## ENHANCING EFFECTIVENESS OF DEVICES IMPLEMENTING WALSH TRANSFORMS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 28, No 1, Jan 85 (manuscript received 18 Jun 84 after revision) pp 31-36

BEBIKH, N.V. and SAURIN, A.A.

[Abstract] A fast Walsh transform algorithm that exploits the intervals between incoming samples to perform intermediate calculations is described. The algorithm is structured such that the information is processed in several iterations; by the time the last pair of samples arrives, most of the investigated signal has already been processed. A device for implementing the algorithm is described that incorporates a computing section and a section that writes the next sample to memory, with the latter having the highest priority in referencing memory. Thus, the calculations are performed during the pauses between samples; when the next sample comes in, the computation is halted until the new sample is entered in memory. The method makes it possible to combine information reception and processing, and to implement high speed Walsh transformation devices at low hardware cost, thus increasing the efficiency of digital signal processing systems. References 2 Russian.  
[204-6900]

# SYNCHRONIZATION ACCURACY REQUIREMENTS FOR PULSE-POSITION MODULATION OF SIGNALS WITH NONSINUSOIDAL CARRIER

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 28, No 1, Jan 85 (manuscript received 11 Jun 84 after revision) pp 39-43

TRIFONOV, A.P., MANELIS, V.B. and NECHAYEV, Ye.P.

[Abstract] Pulse-position modulation of signals with carrier described by a Walsh function is examined with allowance for noise occurring in the communications channel and the synchronization errors that ordinarily occur. Exact asymptotic expressions are found for the characteristics of the estimate of the parameter transmitted by such signals. Two types of pulse position modulation are investigated: one in which only the time position of the rectangular pulse changes, and one in which the time position of the carrier also changes. The latter is found to be preferable to the former as long as the signal/noise ratio is not too low. References 8 Russian.  
[204-6900]

UDC: 621.58:621.382

# OPTIMALITY OF STEP APPROXIMATION OF HARMONIC SIGNAL BY WALSH FUNCTIONS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 28, No 1, Jan 85 (manuscript received 17 Jan 84) pp 78-80

VASYUKOV, V.V., KLIMOV, V.S. and UTKIN, M.A.

[Abstract] This study investigates the step approximation of sinusoidal signals with the help of Walsh functions. The  $2(N/4 - 1)$  odd harmonics that are closest to the first harmonic are found to be lacking if  $N = 2^m$ . The use of Walsh functions is thus found to be optimal simultaneously with respect to the two criteria of greatest practical importance: the minimum harmonic coefficient, and the highest possible number of the first of the lowest of the upper harmonics present in the spectrum. References 3 Russian.  
[204-6900]

## MOSCOW TELEPHONE SYSTEM CONSTRUCTION TRUST ACHIEVEMENTS IN 1983

Moscow VESTNIK SVYAZI in Russian No 7, 1984 pp 7-9

[Article by Aleksandr Mikhaylovich Lukashov, director of the Moscow Telephone System Construction Trust, "Competition Diary: Work Efficiently and with High Quality! In the Vanguard"]

[Text] Based on the work totals in 1983, the collective of the "Mostelefonstroy" trust was awarded the Challenge Red Banner of the CPSU Central Committee, the USSR Council of Ministers, the All-Union Central Trade-Union Council and the Komsomol Central Committee. The director of the trust, Aleksandr Mikhaylovich Lukashov, tells VESTNIK SVYAZI readers how the success was achieved.

In competing under the slogan "For High Construction Quality - The Workers' Guarantee", the "Mostelefonstroy" trust fulfilled all of the plan economic indicators in 1983. Thus, the construction and installation work volume plan was completed by December 8th, while by the end of the year, it was fulfilled by 106.7%. The annual assignment for labor productivity was fulfilled by 103.5%; this was a growth of 5.2% over the previous year. In this instance, the given increase was achieved solely through the increase in the set standard output, which rose by 5.6%. The rise in labor productivity was responsible for a 3.9% wage increase.

We fulfilled the plan for the commodity construction output volume by 107.1%. The incompleted production volume was curtailed by 19.7%. As a result, 1,766,000 rubles of income above the plan were obtained. It should be noted that all construction and installation administrations and subsidiary enterprises successfully fulfilled the plan indicators.

The maximum level of expenditures per ruble of construction and installation work amounted to 63.7 kopecks; the plan figure was 66.8 kopecks.

The fulfillment of the major economic plan indicators made it possible to successfully implement the plan for bringing capacities on line and turning the finished facilities over for operation. Some 39 ATS's [automatic telephone exchanges] with an overall capacity of 146,450 numbers were delivered as part of a complete system with the line, interoffice and intercenter facilities

(according to the plan, it was necessary to deliver 22 ATS's with an overall capacity of 137,200 numbers); the Moscow to Pavlov-Posad coaxial cable trunk and a number of the most important national economic and special communications projects were also brought on line.

The quality of the delivered communications facilities is characterized by the following data: 66.6% of the facilities were turned over with a rating of "excellent"; 33.3% had a rating of "good".

The trust collective was successful in achieving the positive results for many reasons.

Constant and considerable work to mobilize the collective for the unconditional fulfillment of the set assignments, primarily, the on-time execution of the construction and installation work and the operational delivery of the finished communications facilities, was accomplished under the supervision of the party and trade-union organizations.

Socialist competition and the movement for a communist attitude towards labor are some of our main assistants in achieving positive work results, especially in boosting labor productivity and in locating performance reserves.

All of the collectives and individual workers of the trust developed and accepted stepped-up obligations, in which the major aspects of the working, living and everyday, as well as cultural and public life were reflected. The competition was organized among the collectives of the construction and installation administrations and subsidiary enterprises, sections, shops, teams and brigades, as well as between the Komsomol youth brigades. Considerable attention was devoted to compiling the competition totals: the effectiveness of the competition, comparability and clarity. Specific and stepped-up obligations were adopted by each collective and worker.

Some 2,644 workers participated in the competition for a communist attitude towards labor; more than 1,800 workers of the trust were awarded the title of "Communist Shock Labor Worker". More than 90 collectives of the trust competed for the awarding of the title "Communist Labor Collective", while 132 collectives fought for the honor of "Model Collective". Almost 60 brigades of the trust fulfilled the 1983 assignments ahead of schedule.

The extensive and specific organizational and engineering measures, which incorporate the best experience of our collective in setting up the organization of the construction and installation work, and in utilizing measures for the scientific organization as well as advanced methods of production and new equipment, which we developed and introduced, all promoted the successful execution of the work assignments.

The practice of recent years has convincingly demonstrated the advantages of work performance by means of brigade contracting. Some 1,146 workers in 121 brigades worked on this basis in the trust in 1983. They performed 9,434,000 rubles of construction and installation work, which amounted to 29.8% of the total work volume performed by the trust. The average annual output in these brigades amounted to 23,468 rubles while the average for the trust was 17,620 rubles.

The success of these brigades was achieved on one hand by the high level of work organization and the good labor discipline. The work was executed in a comprehensive fashion and the machinery and mechanisms were utilized efficiently and completely loaded. On the other hand, a responsible approach to the work by the foremen, construction superintendents and section chiefs who monitored the timely and complete preparation of the facility for the start of work as well as the supply and completeness of the sets of cables, equipment and materials played a definite positive part. All of this practically eliminated working time losses and significantly reduced labor expenditures; in just the installation of two ATS's, these expenditures were curtailed by 1,524 man-days.

A positive result was also obtained from the use of a job contract plus bonus wage rate system of labor wages. With us, this system comprise 84% of the total fund of piece-rate worker wages in 1983. Some 2,985,000 rubles in wages were paid in accordance with the job contract plus bonus wage rate system; the overall wage fund for piece-rate workers for construction and installation work was 3,553,000 rubles. The proportionate share of bonuses in the wage fund for workers working using the job contract plus bonus rate system amounted to 13.5%.

The introduction of new equipment, advanced technology and efficiency improvement, as well as the application of the scientific organization of labor played a considerable part in the fulfillment of the plant assignments. The laying and hook-up of new multipair TPP type cables with from 1,400 to 2,400 pairs were mastered; for the first time in the nation, polyethylene jointing sleeves were started in production at the prototype plant of the trust for the installation of these cables; the economic impact from the production and introduction of just one kilometer of TPP 2400 x 2 x 0.32 cable was 1,686 rubles. A transition was made to the construction of telephone cable conduit inspection points made of reinforced concrete parts, also fabricated at this same plant. This made it possible to practically dispense with the use of scarce brick in the construction of manholes and boost labor productivity by 20 to 25% in the construction of the telephone conduits.

Further work continued on the mechanization of heavy and labor intensive work as well as the building-up and renewing of the fleet of machinery, mechanisms and various attached accessories with their newest and higher performance types. This made it possible to increase the level of mechanization to 76.4% when working on road surfaces, frozen ground, and digging the trenches and excavations for the construction of telephone conduits. This is a good achievement in Moscow where there is a high density of the various underground conduits.

We succeeded in reducing the manual labor in the loading and unloading operations and cable laying down to 2.3%. The level of mechanization in running the cable in conduits was 97%. The installation and the alignment of the electronic subscriber registers with battery pulse sensors (EARB) instead of relay sensors was accomplished for the first time in Moscow at eight of the automatic telephone exchanges, which made it possible

to reduce the total number of bays by 350%, since 12 bays are installed instead of 40 bays at 1 ATS for 10,000 numbers; the number of wires and connections for the wiring between the bays was reduced by 260%. The anticipated economic efficiency of the operation of the battery pulse transducer registers will amount to 0.5 rubles per subscriber number annually.

The further application of the progressive cable installation method using multipair connectors continued in 1983 in the trust. The use of these connectors increases labor productivity by 25 to 30%. The introduction of crossbar telephone exchanges is now underway on the Moscow telephone network; the installation of even more sophisticated systems, including a considerable quantity of electronic units - the ATSKU - was accomplished in 1983 in 17 automatic telephone exchanges. The most labor intensive and technically difficult operations have been practically fully automated: those of checking and breaking-in the ATS equipment and multiplex units and systems. This was achieved by means of the introduction of Soviet-made automatic testing and conditioning equipment, which makes it possible to automate the alignment and aging of subscriber sets in a multiple crossbar connection field of AV [?subscriber call?] blocks when making outgoing and incoming calls; it also automates the quality control testing of the inter-exchange wiring, the checking of the correctness of the installation of the multiple crossbar connection fields of the group selector blocks, the conditioning of subscriber and incoming senders, outgoing connection sets as well as the testing of the correct operation of outgoing and incoming patchcord sets and the conditioning of code receivers.

The installation of equipment in technical operation centers (TsTE) at 22 Moscow municipal telephone network facilities was started for the first time in the nation. The creation of such centers makes it possible to consolidate telephone units of up to 400,000 - 500,000 numbers, reduce labor expenditures for network servicing and improve telephone service quality.

The installation of telephone exchange cable using pistol-grip reel dispensers was started in 1981; the work of installation workers has been significantly simplified and the working conditions considerably improved since then.

The collective of the trust has considerable work on the introduction of new automatic number identification (AON), both relay-type and electronic equipment, in the Moscow telephone exchanges. Automatic number identification equipment has been installed at the present time in 264 automatic telephone exchanges, in particular, in 9 ATS's in 1981 (46,000 sets), in 9 ATS's in 1982 (64,000 sets) and in 17 ATS's in 1983 (87,000 sets).

A fundamentally new Soviet-made multichannel pulse code modulation system, the IKM-30, which has a number of advantages over the KAMA system, is being used in the construction of the interoffice and intercenter lines in addition to the KAMA equipment for multiplexing the junction lines. By the end of 1983, 1,117 IKM-30 systems had been installed and aligned in the Moscow municipal telephone network. The introduction of the modernized



IKM-30-4 equipment and the 120-channel IKM-120 pulse code modulation equipment has also started.

The introduction of modern ATS systems and new high frequency multiplexing equipment has in turn necessitated the outfitting of the construction and installation administration with the latest electrical measurement instruments and automatic testing equipment. More than 60 types of instruments for various purposes are being used in the telephone exchange construction and installation administrations of the trust.

Instead of the standard metal structures, a "grating" type metal structure has been introduced at Moscow ATS's since 1979 for the purpose of saving telephone exchange cable. It makes it possible to save 15 km of TSV telephone exchange cable in just one ATS with a capacity of 10,000 numbers.

The economic impact of the introduction of the new equipment and advanced technology amounted to 112,600 rubles on the whole for the trust in 1983. More than 31 job positions were eliminated. A factor of no small importance that promoted the fulfillment of the plan assignments was the activation of efficiency improvement proposal work. The economic effect from the use of 580 of the submitted 749 efficiency improvement proposals was 519,000 rubles. Review inspections are continually being conducted in the trust for the better formulation of efficiency improvement work in the construction and installation administrations and enterprises of the trust.

Considerable work was done in 1983 in saving material resources, as a result of which, 224 tons of petroleum products were saved as well as 74,000 KWH of electric power, about 50 tons of metal and about 105 cubic meters of lumber. The economic savings amounted to 92,000 rubles in this case.

All of the cited measures and others implemented in the trust during the year enabled the collective to successfully handle the set assignments and create a good foundation for the fulfillment of the 1984 plan assignments and those of the 11th Five-Year Plan as a whole.

The collective of the "Mostelefonstroy" trust has assumed the socialist obligations for 1984 of fulfilling the annual plan for construction and installation work volume by December 25th, deliver for operation to Moscow ATS's a total capacity of 130,000 numbers, including 3 ATS's with a capacity of 22,600 numbers ahead of schedule as well as assuring the turnover of the exchange equipment, 12 ATS's with the guarantee certificate and 99% of the facilities and units being brought on line are to be turned over with a rating of "good" or "excellent".

Additionally, having assessed their capabilities for further improving the organization of construction and installation work, introducing the

latest electrical equipment and alignment instruments for installation and set-up work, as well as advanced labor methods and production techniques, the "Mostelefonstroy" trust has adopted a challenge plan to increase labor productivity one percent higher than the plan level and reduce the actual cost of construction and installation work by an additional 0.5% in 1984.

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DEVICE FOR CANCELLING INTERFERING SIGNAL IN RECEPTION OF TWO FM SIGNALS  
WITH OVERLAPPING SPECTRUM

Frunze IZVESTIYA AKADEMII NAUK KIRGIZSKOY SSR in Russian No 6, Nov-Dec 84  
pp 24-26

ZHUMABAYEV, M.

[Abstract] Methods were developed and published in foreign and domestic literature for suppression or cancellation of interferences of two FM signals with an overlapping spectrum. Based on a proposed method a two-channel device was constructed consisting of two phase shifters, two synchronous detectors, and subtraction units. The first phase detector monitors the useful signal with carrier  $f_1 = \omega_1 / 2\pi$ ; and the second phase detector monitors the interfering signal with carrier  $f_2 = \omega_2 / 2\pi$ . The device is capable of compensating the interfering wideband FM signals with overlapping spectrum. The efficiency of employing the device with a wideband radio communication systems was also studied experimentally. A standard domestically manufactured modulator-demodulator "Voskhod" was used as a source of the useful and the interfering signals and the results of the experiment are included. The electromagnetic compatibility of radio relay lines and other communication systems employing FM for transmission of TV messages can be improved significantly by the device. Simultaneous broadcasting of two different black and white TV programs can be carried by a single radio relay system where the difference between the carrier frequencies is at least 1 MHz. The application of the developed device can improve the efficiency of utilization of the frequency band. Figures 2; references 6: 5 Russian, 1 Western.

[195-12755]

## SUCCESSFUL COMPLETION OF FIVE-YEAR PLAN

Moscow VESTNIK SVYAZI in Russian No 1, Jan 85 pp 2-3

SHAMSHIN, V.A., Communications minister of the USSR

[Abstract] It is assumed that 1984 and current five-year plan assignments specified by the 26th CPSU Congress will be fulfilled or overfulfilled. During the current five-year plan total telephone line length will increase by a factor of 1.8, and the number of telephones by a factor of 1.3. Special attention was given to the development of the rural telephone communications and during the last 10 years the number of telephones in the rural areas has doubled. Great contributions were made by communication personnel in the development of the Baykal-Amur railroad and a powerful radio-relay line was put in operation in 1981 along the entire length of the road. Accelerated development and improvement of the TV services is under way and at the present time the First Central TV program is now received over an area containing 92% of the population. Computers and space communication greatly contributed to the introduction of advanced technology. However improvements are needed in the direction of scientific and technical progress. Several million residents of the rural areas are still not receiving the TV programs, and only a quarter of all families have telephones. The level of the long distance telephone communication automation is not sufficiently high. To provide the telephone services by accelerated measures requires concentrated effort by several organizations including the suppliers of the communication equipment and cables, ministries of the communication industry, the electro-technical industry etc.

[193-12755]

## BIHARMONIC MODE MEDIUM WAVE RANGE TRANSMITTERS

Moscow VESTNIK SVYAZI in Russian No 1, Jan 85, pp 30-31

PROSHUTIN, N.V., head of radio center No 11 SUR-2 production laboratory, and SOBOLEV, N.M. head of shop

[Abstract] Since 1980 radio center No 11 SUR-2 worked on biharmonic mode operation for powerful medium wave range transmitters in order to reduce consumption of electrical energy utilizing transmitters with 50% industrial efficiency. The functional diagram of the high frequency circuit for all transmitters consists of five stages: 3 preamplifiers, a driver stage using 2 or 3 tetrodes, and output stage with 3 or 4 GU-65 tubes. Design requirements include reduction of inductances in the capacitive circuit while the overall Q-factor must be high in order to obtain a high equivalent impedance for third harmonics. Inductances and capacitances must be connected to the circuit at a single point so as not to produce additional phase shifts and local resonances and to assure low wiring impedance from this point to the grid of the tube. It is also important to be able to provide an identical voltage shape at the grids of all parallel connected tubes. These

requirements can be satisfied with the available equipment, and the required oscillator excitation shape can be obtained. Bi-harmonic mode operation increased electronic efficiency of the oscillator to 90%, and industrial efficiency increased by about 8 to 10%. Bi-harmonic mode operation increases the reliability of the oscillator tubes and extends their life-time by about 10%. Measurements indicated that transmitter quality does not deteriorate, and the level of harmonics at the output does not increase, which makes it possible to employ a system of 2 sections with filters for rejecting the second and the third harmonics, or a system of 4 sections without filters. Bi-harmonic mode operation transmitters are not very different from other types of transmitters and do not require special attention or additional personnel for operation. Figures 4.

[193-12755]

#### SERIES CONNECTION OF ATK-20 SUBSCRIBER SET

Moscow VESTNIK SVYAZI in Russian No 1, Jan 85 pp 31-32

GLUSHCHENKO, V.F., chief engineer of the electrocommunication and broadcasting branch of Kirgiz SSR

[Abstract] A circuit was developed and installed at the ATS-20 telegraph exchange which makes it possible by dialing a number to establish an input contact in series with a first subscriber set (AK), but if this set is occupied, with a second set. For this purpose the relay contacts of the first AK, which are not used with a two wire operation, are connected to a sensor of a register, thus establishing the required circuit. The circuit consisting of several relays, switches and a register is described. Figure 1.

[193-12755]

## ELECTRON DEVICES

### NONLINEAR PROPAGATION OF INFRARED RADIATION IN MULTI-VALLEYED SEMICONDUCTORS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 19, No 1, Jan 85  
(manuscript received 30 Apr 84) pp 77-82

TOMCHUK, P.M. and CHUMAK, A.A., Institute of Physics, Ukrainian SSR  
Academy of Sciences.

[Abstract] The interaction of electrons in multi-valleyed semiconductors with strong electromagnetic radiation is investigated. The interaction of electrons and inter-valley phonons in the electromagnetic wavefield is calculated by finding the electron distribution functions. The redistribution of electrons between valleys results from different heating of the electrons in different valleys, as well as different energy bias of the valleys due to vibrational electron movement in the wavefield. The inter-valley collision integral is obtained by the movement equation method. Inter-valley repopulation by the electromagnetic field, which influences the electron concentrations in different valleys, is analyzed. Wavefront conjugation is investigated as an example. The use of multi-valleyed semiconductors as a nonlinear medium for dynamic holography in the infrared band is discussed. References 7: 5 Russian, 2 Western.

[203-6900]

### DISTINCTIVE FEATURES OF ELECTRICAL AND TENSOELECTRICAL PHENONEMA IN GALLIUM-ARSENIDE SCHOTTKY-BARRIER STRUCTURES IMPLANTED WITH OXYGEN IONS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 19, No 1, Jan 85  
(manuscript received 4 Apr 84) pp 92-95

MAKSIMOVA, N.K., ROMANOVA, I.D. and FILONOV, N.G., Siberian Physical-Technical Institute imeni V.D. Kuznetsov, Tomsk State University.

[Abstract] This study describes an investigation of the mechanisms underlying current transfer and the tenso-sensitivity of Schottky-barrier diodes based on gallium-arsenide with deep centers performed by oxygen ion implantation. The voltage-current and voltage-capacitance characteristics are investigated for temperatures ranging from 77 to 300K, as well as the temperature-stimulated currents and the diode characteristics under

hydrostatic and anisotropic pressure. Analysis of the electrical characteristics of the diode structures shows that heat treatment at 600° C reduces the concentration of the centers that are responsible for compensating conductivity of the gallium arsenide and hysteresis of the reverse current; however, it activates the levels that participate in generation-recombination processes. The characteristics of the electrical and tenso-electrical phenomena are found to be caused by the occurrence of deep centers, which are related with oxygen as well as radiation defects. The findings confirm the assumption that oxygen participates in the degradation of the electrical characteristics of gallium-arsenide Schottky-barrier diodes. References 14: 12 Russian, 2 Western.

[203-6900]

#### MOBILITY OF NONEQUILIBRIUM ELECTRONS IN P-TYPE GaAs CRYSTALS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 19, No 1, Jan 85 (manuscript received 31 Jul 84) pp 118-122

LAGUNOVA, T.S., MARUSHCHAK, V.A., STEPANOVA, M.N. and TITKOV, A.N., Physical-Technical Institute imeni A.F. Ioffe, USSR Academy of Sciences.

[Abstract] This study investigates a new possibility for determining the mobility of nonequilibrium electrons in  $A^{III}B^V$  P-type compounds that is based on the close relationship between electron scattering and spin relaxation processes. The method is employed to investigate the concentration and temperature behavior of nonequilibrium electrons in P-type GaAs crystals. The spin relaxation time of the conductivity electrons is measured by the optical orientation method. The experimental values are found to agree well with the theoretical estimates, indicating that the proposed method is simple, as well as reliable and informative. References 15: 6 Russian, 9 Western.

[203-6900]

#### E3 CENTER CONCENTRATION PROFILE IN GALLIUM-ARSENIDE

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 19, No 1, Jan 85 (manuscript received 19 Mar 84) pp 147-150

MAMONTOV, A.P. and PESHEV, V.V.

[Abstract] The  $N_{E3}$  profile in reverse-biased Schottky barriers is investigated, and the influence of applying U to barriers irradiated for U = 0 is studied. It is found that the concentration of E3 centers in an irradiated space-charged region is independent of the electrical field intensity, and that the profile of the concentration of these centers changes abruptly near the neutral volume of GaAs. The creation of a space-charge region at the location of an irradiated neutral volume has no effect

on the E3 center concentration, which provides experimental confirmation of the existence of 'radiation jarring' of the lattice. References 6:  
5 Russian, 1 Western.

[203-6900]

INVESTIGATION OF EFFECTIVENESS OF INJECTION OF P - N-JUNCTIONS BASED ON  
LIGHTLY DOPED GaAs

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 19, No 1, Jan 85  
(manuscript received 31 Jul 84) pp 167-169

GRIGOR'EV, B.I., DANIL'CHENKO, V.G. and KOROL'KOV, V.I., Physical-Technical  
Institute imeni A.F. Ioffe, USSR Academy of Sciences.

[Abstract] A method is proposed for investigating the efficiency of  $p^+ - n^0 + n^+$  - and  $n^+ - p^0 + p^+$  -structure high-voltage gallium-arsenide p - n-junctions obtained by liquid epitaxy. The specimens consisted of structures of several types with different charge carrier concentrations in the emitter and base regions, different thickness and different type of base layer conductivity. The emitter efficiency of the diode structures was determined indirectly by passing pairs of rectangular forward- and reverse-current pulses through the diode, measuring the duration of the phase of the high reverse conductivity of the diode and calculating the emitter efficiency. The coefficient of injection is found to drop abruptly even in significantly assymetrical gallium-arsenide p - n-junctions at currents exceeding 150 A/cm<sup>2</sup>; the investigations show that a similar relationship between emitter efficiency and current should be expected in other devices as well (such as dynistors, thyristors and high voltage transistors). References 10 Russian.  
[203-6900]

UDC: 621.382.323

INVESTIGATION OF LONGITUDINAL DISTRIBUTION OF CHARGE FORMED BY 'HOT'  
CARRIERS IN MNOS TRANSISTORS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 28, No 1, Jan 85 (manuscript received 28 Apr 84 after revision)  
pp 67-69

KROLEVETS, K.M. and STIKANOV, V.Ye.

[Abstract] This study investigates the longitudinal distribution of the charge formed by 'hot' electrons in metal nitride oxide semiconductors (MNOS) transistors. An analysis of MOS transistors is performed on the assumption that mobility is independent of the magnitude of the field in the gate dielectric and the charge constant of the dielectric. Experiments are conducted with planar MNOS transistors with polysilicon gates and



an induced n-channel. The behavior of the total conductance of the channel measured between the source and the drain is analyzed and found to be described by a step function. References 5: 1 Russian, 4 Western.  
[204-6900/

UDC: 621.382.8

#### HIGH-ENERGY-RESOLUTION QUANTUM GALVANOMETRY BASED ON SUPERCONDUCTING INTEGRATED CIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 6, Nov-Dec 84 (manuscript received 9 Feb 84) pp 529-538

BAKHTIN, P.A., VASENKOV, A.A., MASALOV, V.V., MAKHOV, V.I., SRETENSKIY, V.N. and TYABLIKOV, A.V.

[Abstract] An integrated study of the design principles of measurement systems based on superconducting quantum interferometers is described. Taken together, the methods for optimizing integrated SQUID design facilitate quantum galvanometry with good energy resolution. The use of single-junction and dual-junction SQUIDS is explained. A quantum galvanometric measurement system based on a superconducting integrated circuit is described. It is found that quantum galvanometry makes it possible to set up new experimental investigations in microelectronics, high precision measurements and metrological equipment. References 28: 20 Russian, 8 Western.  
[199-6900/

UDC 535.232.6:537.226

#### SOME RESULTS OF AN INVESTIGATION OF HIGH LINEAR PYROELECTRIC RADIATION DETECTORS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84 (manuscript received 2 Dec 83) pp 4-6

NIKOLAYEV, Ye. P.

[Abstract] It is shown that the application of a constant polarizing voltage field to pyroelectric radiation detectors (PRD), particularly in the case where ferrosoft (capacitor) ceramics are used, makes it possible not only to decrease considerably certain shortcomings in PRD (up to the magnitude of the amplitude authorization of the unit), but also to improve some other of their parameters. It is shown that improvement of the metrological parameters is the basic advantage of PRD which have had a polarizing voltage field applied. The outlook for the use of such PRD for precision radiometric measurements is presented. Figures 3; references 4: 3 Russian, 1 Western.

## REGENERATIVE PROCESSES IN A RADIO FREQUENCY JOSEPHSON INTERFEROMETER

Moscow ZHURNAL EXPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 88,  
No 1, Jan 85 (manuscript received 21 March 84) pp 134-144

GUSEV, A.V., and RUDENKO, V.N., Moscow State University

[Abstract] Superconducting Quantum Interference Devices (SQUID) with one or several Josephson junctions are used in experimental physics at sensitive recording elements, capable of measuring weak currents, voltages, magnetic or electric fields, their gradients, etc. Theoretically, the ultimate sensitivity of the SQUID is limited only by thermal fluctuations of the current's normal components at the junction and thermal noise. However, the high potential sensitivity of the SQUID is normally not realized because of noise in the electronic circuits and difficulties of matching these circuits with interferometers. A new effect was recently discovered experimentally in the behavior of a hysteresis-type SQUID, which is a phase modulation of induced oscillations proportional to the external signal for pumping amplitude in the gap between the adjoining plateaus. The sensitivity in this mode of operation was somewhat higher than the sensitivity of an identical SQUID, operating in a regular AM mode. A theoretical explanation of this phenomenon was attempted here. First, equations were derived for a hysteresis SQUID describing its behavior at the first plateau. An improved semi-phenomenological model was then developed describing quantum jumps of the magnetic flux in the interferometer. Thereafter, an analysis was made of the dynamic processes in the gap between the first and the second plateau, and finally, a prognosis was made of a hysteresis SQUID's ultimate sensitivity for all possible modes of operation. SQUID can be considered a circuit with internal feed-back. Normally, when the operating point is selected at the horizontal section of the voltage vs. current curve, the feed-back is negative and stabilizes the circuit. In the new operating mode outside the plateau, when the working point is in the gap between the adjoining plateaus, the feed-back is positive, and a negative conductivity is introduced, providing for a possibility of realizing a regenerative mode of operation with low noise temperature of the negative resistance, which depends only on the physical temperature of the junction. Thus, for a specified noise temperature of the measuring device, the admissible value of the coupling coefficient can be determined along with the ultimate value of the regenerative coefficient. Figures 2; references 16: 13 Russian, 3 Western.

[I94-12755]

UDC 621.316.542.064.241.027.9.001.4

PERFORMANCE TESTS OF A 1,150kV ON-OFF SWITCH

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 85 (manuscript received 21 May 84)  
pp 2-5

RUL'SKAYA, L.A., engineer, PERTSEV, A.A., candidate of technical sciences,  
All-Union Electrotechnical Institute.

[Abstract] Shunt reactor spark connection is used in 1,150kV electrical transmission line protection systems. A special on-off switching apparatus automatically and without lag connects a shunt reactor to the line in the case of overload, and is also used for routine switching operations. An experimental VO-1,150 switch was designed and tested. The principal innovation is a device for lagless connection to a reactor consisting of two series connected open spark gaps with inter-electrode intervals of 1.0 and 1.5 meters. Strict requirements regulate the electrical characteristics of the spark connection: discharge voltages cannot exceed 1,600 kV, or be below 1,160 kV in a wide range of the applied voltage waveshape variations and front durations of 500 to 5,000 ms. The maximum lightning discharge voltage cannot exceed 2,000 kV. A lagless connection was developed using open spark gaps for different configurations of the electric field. The relations between the gap field and discharge characteristics were experimentally examined and an optimum configuration selected. Tests of experimental and production VO-1,150 switches for spark activation capacity were made under various operational and atmospheric and environmental conditions and confirmed the adequacy of the design. Figures 4; references 3: Russian.  
[T92-12755]

## EXPERIMENTAL STUDY OF EXTERNAL MAGNETIC FIELDS IN GENERATOR ROOM OF SAYAN-SHUSHENSK HYDROELECTRIC POWER PLANT.

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 85 (manuscript received 29 March 84) pp 32-35

KHAGEMEYSTER, Ye. A., candidate of technical sciences, and VIKHAREV, A.P., eng. Kirov polytechnical institute.

[Abstract] Reducing the effect of magnetic fields induced by the electrical power generators in the environment is becoming a problem of great concern. The major source of the external fields at the electric plants are the current conductors and zero terminals of the generator's stator windings. Accurate field computations cannot be made because of factors affecting the field distribution including the complexity of the power generator configuration, magnetic irregularity of the surrounding area and the need to take into account their three-dimensional and three-phase characteristics. Experimental studies were therefore conducted at the Sayan-Shushensk hydroelectric power plant which indicated the presence of external magnetic fields in the vicinity of operating generators. An external 50 Hz magnetic field intensity was detected in the relay protection and automatic measurement instrument area which in terms of the nominal stator current amounted to 400-1,000 A/m. This exceeds the value stipulated by the GOST 6570-75, causing a reading error greater than the 3% tolerated by the GOST. Assuming 23.3 billion kWh projected annual output, there will be a measurement error of more than 700 million kWh at the plant. Methods must be developed for a correct calculation of the effects of the external magnetic fields by taking into account the actual environmental conditions at power plants, the geometry of the current conductors, the effect of the ferromagnetic bodies etc, which could be applied when designing the power plants. The measuring instruments which can be affected by the magnetic fields must be positioned taking this factor into account. Figures 4; references 5: Russian.

[I92-12755]

## TOWARD THE DESIGN OF A SINGLE-PHASE INDUCON BASED ON SHELL-TYPE MAGNETIC STRIP CIRCUIT

Kiev TEKHNIЧЕСКАЯ ELEKTRODINAMIKA in Russian No 6, Nov-Dec 84 (manuscript received 15 May 84) pp 20-25

VOLKOV, I.V. and SOKOLYANSKIY, V.N.

[Abstract] This study examines an inducon - an inductive-capacitive voltage-to-current converter with distributive inductance and capacitance. Basic relationships between the geometric and electrical parameters of the device are

derived, and optimization of parameters is investigated. An inducon with maximum assigned power of 1 kw and stabilized current of 10 A for a 380 V, 50 Hz line is analyzed as an example. The relationships derived make it possible to design an inducon with the smallest possible size and weight under given technological and design restrictions. References 2 Russian.  
/I66-6900/

UDC 621.313.1.001.4

OPERATING CHARACTERISTICS OF THYRISTOR CONVERTERS WITH INDEPENDENT POWER PLANTS FEEDING COMMERCIAL NETWORK

Kiev TEKHNIЧЕСKAYA ELEKTRODINAMIKA in Russian No 6, Nov-Dec 84 (manuscript received 28 Mar 84) pp 36-39

CHERKASHINA, Z.S., PISKUN, F.I. and KOZAKOV, Yu.V.

/Abstract/ A matching device employing a thyristor converter with a dc section is described. The device makes it possible to prevent triggering of the inverter during malfunctions without interrupting the loading of the independent power plant to the commercial network. A protection device is described that improves the reliability of the matching device significantly. References 4 Russian.  
/I66-6900/

UDC 621.314.621

METHOD FOR ANALYZING ELECTROMAGNETIC PROCESSES IN POWER LINE - RECTIFIER - PULSE-WIDTH CONVERTER SYSTEM

Kiev TEKHNIЧЕСKAYA ELEKTRODINAMIKA in Russian No 6, Nov-Dec 84 (manuscript received 11 Jun 84) pp 45-48

ZHUK, A.K. and ANISIMOV, Ya.F.

/Abstract/ The characteristics of a system consisting of a fixed rectifier and a pulse-width converter are investigated. An analytical method is described for calculating the instantaneous values and harmonic composition of the phase current and voltage of the independent line powering the rectifier - pulse-width converter system. The analytical relationships derived make it fairly easy to determine the power quality indicators in an autonomous network powering such a system. The analytical results are within 10% of the experimental findings. The formulas can be used to determine the optimal parameters of the input filter of the pulse-width converter. References 3 Russian.  
/I66-6900/

UDC 681.327.2:681.324

ANALYSIS OF THROUGHPUT OF CORE MEMORY AND ITS INTRA-SYSTEM INTERFACE IN  
MULTIPROCESSOR COMPUTING SYSTEMS

Moscow AVTOMATIKA I TELEMEXHANIKA in Russian No 1, Jan 85 (manuscript  
received 13 Dec 83) pp 156-167

BOGUSLAVSKIY, L.B. and IGNATUSHCHENKO, V.V., Moscow

[Abstract] With the use of analytical methods, this paper evaluates the throughput of multiprocessor computer systems with a variable number of specialized blocks for forming and allocation of addresses (sources of inquiries), modules and blocks of core memory data, registers in the sections of allocated memory of the interface, with varying methods of maintaining inquiries in the core memory, and with a different linkage structure of the interface. These investigations are directed to the control, analysis, and choice of the structure of a parallel core memory and its intra-system interface for a multi-processor computer system with a rearrangeable structure. Figures 5; tables 6; references 9: 4 Russian, 5 Western (1 in Russian translation).

MICROPROCESSOR RADIOELECTRONIC EQUIPMENT DESIGN

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 27, No 12, Dec 84, pp 91-92

SOLOV'YEV, G.N., Head of the computer department, Moscow Institute of  
Engineering Physics, doctor of technical sciences.

[Abstract] This is a review of "Microprocessor Radioelectronic Equipment Design" by A. G. Aleksenko, A. G. Galitsin and A. D. Ivannikov (Moscow Radio i svyaz', 1984). The book deals with problems of developing microprocessor equipment. The authors examine a single type of microprocessor LSI circuits, that is the widely used KR580 series and consider the design of this type of microprocessor systems in great detail. All major LSI microprocessor circuits with KR580 are described. LSI circuits for parallel and series interfacing KR580VV55 and KR580VV51 are also examined along with

the KR580IK80A processor, as well as the interrupt controllers KR580VN59, and the controller of the direct memory access KR580VT57, programmable timer KR580VI53, and the controller of display terminal KR580VG75. Software for the microprocessor system and the fundamental concepts of automated programming are described including the most common languages for programming KR580 series microprocessors. Major circuits for the microprocessor main units using the KR580 series LSI circuits including the processor unit, matching units etc. are described. Debugging functions of the microprocessors are covered including the INTELLEC MOS-800 system by INTEL, USA, provided with a disk drive ISIS-II, which is used for designing LSI circuits with KR580 devices but the functions of the domestically manufactured SM-1800 computer and the SO-04 debugging system would have been interesting for the Soviet reader. Two examples of KR580 microprocessor systems for plotters and digital filters are covered. A better title for the book would be "Designing electronic equipment with the KR580 microprocessor," since the book deals mainly with this device.

/I91-12755/

#### K580, KR580 SERIES LCI MICROPROCESSORS

Moscow RADIO in Russian No 12, Dec 85 pp 55-56

A. YUSHIN.

/Abstract/ This the fourth in a series of reference sheets published on the K580 and KR580 series large scale integrated microprocessors. Described are the functions of modes numbered 2 through 5, the names of the leads and the classification and operating parameters of an unspecified member of the series, as well as similar information on the KR580VN59 programmable interrupt controller and the KR580VG75 programmable video terminal controller. Functional diagrams of the latter are presented and explained.

/Z05-6900/

UDC 621.378:621.375.826:519.2

INVESTIGATION OF ENERGY CHARACTERISTICS OF He-Ne TELESCOPIC LASER OPERATING  
AT  $\lambda = 3.39 \mu\text{m}$

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, pp 28-29

DMITRIYEV, A.K. and NEKRASOV, Yu.V.

[Abstract] The influence of the gain and aperture of the cavity in the stable region on the energy characteristic of the telescopic He-Ne laser is investigated. The experimental findings were compared with the analytical results by measuring the saturated gain throughout the entire working current range in the active element by passing the radiation from a different He-Ne laser operating at  $3.39 \mu\text{m}$  along the axis of the active elements of the telescopic laser and measuring the density of the light passing through the amplifying medium. The half-width of the laser power contour was calculated as a function of the unsaturated gain. A simplified model of the laser is described. The effective unsaturated gain averaged over the cross-section is smaller than that measured along the axis of the active element. When the gain is far above the threshold, the experimental values of the lasing region exceed  $\Delta$ , chiefly because of the elevated estimate of diffraction losses near and beyond the stability region. References 5: 3 Russian, 2 Western.  
[226-6900/

UDC 681.2:537.7

DISTORTION OF FOURIER-FORM SIGNALS DURING GAUSSIAN LIGHTING OF INPUT  
TRANSPARENCY IN COHERENT OPTICAL SPECTRUM ANALYSERS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian, No 11, Nov 84  
(manuscript received 27 Feb 84) pp 1-4

KOLOBRODOV, V.G., SAKHNO, S.P. and TYMCHIK, G.S.

[Abstract] Distortions of the parameters of a Fourier-form signal in coherent optical spectrum analysers (COSA), which occur during gaussian lighting of the aperture of an input transparency are determined and investigate



investigated. Analytic dependences describing the distortions are obtained. Practical recommendations are offered with respect to a decrease of these distortions by means of an appropriate choice of the aperture dimensions of the input transparency and the radius of the laser beam at the input plane of the COSA. Figures 4; references 7: 6 Russian, 1 Western.

UDC 621.383.52:015.51

#### CHOICE OF RATIONAL PARAMETERS OF PHOTODETECTOR SECTION WITH REACTIVE LOAD

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian, No 11, Nov 84 (manuscript received 30 Aug 83) pp 6-9

MITSENKO, I.D. and LEGKIY, V.N.

/Abstract/ In the development of phase-pulse systems of distance measurement, the problem arises of forming attenuating harmonic oscillations in the circuit of a photodetector with a reactive load, on exposure to light pulses. Up to the present time, absence of sound methods for the design of such a photodetector device (PDD) required complex and time-consuming experimental investigations. The paper demonstrates that by use of a comparatively simple mathematical apparatus, it is possible to derive the necessary analytical formulas and to select the efficient parameters of a phase-pulse PDD, the block diagram of which does not differ from that of a unit developed in the old way. Figures 4; references: 4 Russian.

UDC 681.7.069

#### RATIONAL SPACE-TIME FORMATION OF SIGNALS IN RASTERS OF OPTICAL-ELECTRONIC SYSTEMS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian, No 11, Nov 84 (manuscript received 26 Dec 83) pp 9-11

VORONIN, V.I.

/Abstract/ A method for shaping signals in the form of a pseudo-random code sequence in optical-electronic systems with mobile image analyzers, the so-called rasters, is considered. Data are obtained which make it possible to evaluate the rationality of using this method of coding, as well as a method described in U.S.A. patent No. 3541335, class 250-203, and the pulse method of modulation. Figures 2; references 6: 5 Russian, 1 Western.

## MODELING OF SIGNALS AT OUTPUT OF MULTIPLIER PHOTOTUBES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 13 Jan 84) pp 14-15

YENDOVITSKAYA, L.G.

[Abstract] An algorithm with known average characteristics of multiplier phototubes (FEU) is presented, which makes it possible by modeling the output signals of a FEU-79 on a digital computer to analyze the form of the output signals as a function of the parameters of the Poisson flow of photoelectrons and to determine the intensity level of the input signals, during which a regime of counting photoelectrons is possible. Figures 2; references: 4 Russian.

## STATISTICAL EVALUATION OF ACTUAL RESOLUTION OF IMAGE RECEIVER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 18 Oct 83) pp 16-19

VYGON, V.G. and LOGINOV, V.V.

[Abstract] The approach used in this paper, one based on a statistical generalization of Raleigh's optical criterion, makes it possible to determine the numerical characteristics of the actual resolution (AR) of an image receiver. A more important result of its use, however, is the introduction of a functional characteristic -- the probability of distinction of two point sources. It, more fully than the AR, reflects the potential possibilities of the transmission of spatial information by a receiver, realizable in the case of use by the recipient of algorithms of the theory of statistical solutions for processing of the image. Calculation of the discrimination characteristics makes it possible to choose the optimum operating condition of a light information system in each concrete situation. Figures 2; references: 6 Russian.

## VISUAL EVALUATION OF THE TRANSFER FUNCTION OF MODULATION OF TELESCOPIC DEVICE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 31 Aug 83), pp 19-23

LUIZOV, A.V., FEDOROVA, N.S., and FEDOROVA, G.A.

/Abstract/ An approximate evaluation of the transfer coefficient of modulation (TCM) of a telescopic device by a visual method is described. Values are used of the ratio of the threshold contrasts during observation of the test objects by the naked eye and with the aid of the investigated device. Four standard binoculars were used during the investigation which differed in the dimensions of the entrance pupil and the value of the visible magnification: BPSH6x24, BPV7x50, BPTs8x30, and BPP10x40. The binoculars were set at infinity so that observations were made without accommodation stress. All the binoculars investigated have an exit pupil with a diameter not less than 4 mm. The pupil of the eye came to 3 mm, i.e., during observation the exit pupil of the binocular was restricted by the pupil of the eye. It is also possible to use the visual method for an approximate evaluation of the quality of a telescopic device with use of its complete pupil. In so doing the possibility must be considered of compensating for aberrations of the individual components in the multistage optical system. The results of the evaluation of TCM by the visual method are shown in Table 1. In Table 2 the results are presented of an investigation of binoculars PPSH6x24 and BPV7x50 with a full exit pupil. In the investigations, the TCM obtained by the visual method differed by no more than 20% from values calculated from aberrations of the device and the range of space frequencies perceptible to the eye. Figures 2; tables 2; references: 3 Russian.

## EFFECT OF DECENTERING OF SPHERICAL SURFACES OF OPTICAL SYSTEM ON POSITION OF IMAGE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 18 June 84) pp 23-26

ZVEREV, V.A., STROGANOV, A.A. and KHLUSOVA, N.I.

/Abstract/ The effect is determined of decentering the spherical surfaces of an optical system on the transverse displacement of the image of the singular point of the object and the slope of the image plane. The possibility of their compensation is illustrated. Formulas are obtained which describe the effect. Figures 4; references 10: 9 Russian, 1 Western.

## POLARIZATION UNIT FOR INVESTIGATION OF MAGNETO-OPTICAL ROTATION AND MAGNETIC CIRCULAR DICHROISM IN SEMICONDUCTORS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 1 Sept 83) pp 31-33

GALANOV, Ye.K., OKSANICH, A.P., POTIKHONOV, G.N., STEPKO, V.A.,  
PETUKHOV, I.P., TUZOVSKIY, A.M. and YELIZAROV, A.I.

[Abstract] The development is described of a polarimeter for measurement of magneto-optical rotation of the plane of polarization and the magnetic circular dichroism in the  $\lambda = 10.6$  micron spectral region. This paper is largely based on six papers published in 1976, 1977, 1979, 1982, and 1983, of which Ye.K. Galanov is the main author. The principal circuit is shown and explained of a unit for investigation of the concentration and mobility of free electrons in semiconductors. The curves are presented of the magneto-optical rotation and magnetic circular dichroism of a  $\text{Cd}_{0.2}\text{Hg}_{0.8}\text{Te}$  semiconductor, grown by the oriented crystallization method at  $T=300^\circ\text{K}$ . It is concluded that, for a detailed interpretation of the fluctuations observed of the magneto-optical rotation and the magnetic circular dichroism, it is advisable to conduct investigations in the temperature range 77...300 K, on both stressed specimens and on specimens having received annealing. Figures 2; references 8: 7 Russian, 1 Western in Russian translation.

UDC 520.2

## DETERMINATION OF APEX COORDINATES OF A PARABOLIC MIRROR

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 24 March 83) pp 42-44

VITRICHENKO, E.A. and VOYTSEKHOVICH, V.V.

[Abstract] The principles of operation are described of a CENTR program intended to determine with high precision the apex coordinates of the parabolic surface of an astronomical mirror, with respect to the center of the Gartman diaphragm. It is assumed that control of the Gartman method is fulfilled. Old and new profiles are shown of the normal deflections of the optical surface. Figures 2; references: 3 Russian.

DETERMINATION OF THE MODULATION TRANSFER FUNCTION OF PHOTOGRAPHIC LENS  
FOR ONE VALUE OF THE MODULATION TRANSFER COEFFICIENT

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 21 Dec 82) pp 44-46

YEVTEYEVA, N.P. and STEFANOVA, O.S.

[Abstract] The results are presented of an investigation of the modulation transfer function (MTF) of series-produced samples of photographic lens with a focal distance of 50-mm for 35-mm reflex cameras. It is determined that the MTF can be determined with a sufficient degree of precision by one value of the modulation transfer coefficient for one fundamental spatial frequency. Recommendations are made with respect to the use in production of this method of determining the quality of photographic lens. Tables 1; references 9: 7 Russian, 2 Western.

UDC 678.744.335

## MATERIALS FOR SOLAR ENERGY CONCENTRATORS BASED ON FRESNEL POLYMER LENS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 20 Dec 83) pp 46-48

FARBEROV, A.M., LEPLYANIN, G.V. and GOLODKOVA, L.N.

[Abstract] An investigation is made of the possibilities for use in the production of large-sized Fresnel lens of organic glass (amorphous, solid, glasslike material made of transparent plastic) based on polymethyl methacrylate with the addition of complex compounds of rare-earth elements (REE), and especial plasticizers. A compound of europium, gadolinium, uranium, and terbium is used as an additive to REE. The emission spectrum of organic glass with such additives, and the magnitudes of light transmission are presented in tables. The advisability is shown of using organic glass with a predetermined transmission spectrum. Tables 6; references: 2 Russian.

## SPACE-TIME ELECTROOPTICAL LIGHT MODULATORS FOR OPTICAL INFORMATION PROCESSING SYSTEM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 30 Mar 84) pp 52-61

BEREZHNOY, A.A. and POPOV, Yu.V.

[Abstract] The principles of operation are examined of electrooptical space-time light modulators (STLM) with electrical and light control methods. The main circuits of the modulators and the distinctive features of their operation are presented. The following concepts are considered: 1) Induced optical anisotropy; 2) Formation of space employment of light wave phase; 3) Transformation of spatial characteristics of optical radiation during read-out; 4) STLM with electrical control method; 5) STLM with light control method; 6) Optical memory and representation of information; 7) Addition and subtraction of two-dimensional optical signals; 8) Spatial differentiation of two-dimensional optical signals in real time; 9) Angular selection of spatial frequencies of two-dimensional optical signal; and 10) Fourier transform of noncoherent optical signal in real time scale. The analysis conducted demonstrated that the STLM make it possible to achieve the fundamental mathematical operations on two-dimensional optical signals in a real time scale, as well as to provide the input, processing and display of information. Figures 7; tables 4; references 40: 39 Russian, 1 Western in Russian translation.

## PROBABILITY CRITERION FOR SELECTION OF A PROMISING TYPE OF PHOTOMULTIPLIER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 20 Jan 84) pp 61-62

VETOKHIN, S.S.

[Abstract] In a preliminary search for a photomultiplier (FEU), promising for counting photons, a probability criterion based on reference literature and technical and operational data sheets concerned with other FEUs is generalized. The results obtained are shown in a table. The possibility shown of using a given type of FEU in photon counters was experimentally determined. Tables 1; references: 9 Russian.

## INVESTIGATION OF STRENGTH AND PLASTICITY OF LITHIUM FLUORIDE CRYSTALS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 11, Nov 84  
(manuscript received 24 Mar 83) pp 28-29

IVANOV, A.V., DERZHAVIN, S.N., REYTEROV, V.M. and FOLOMEYEV, A.V.

[Abstract] The strength and plasticity of lithium fluoride crystals grown by the Stokbarger method in a vacuum were investigated by the symmetrical ring elbow procedure. It was established that the technology of growth substantially affects the strength of lithium fluoride crystals. The magnitude of the plasticity of an FL-V crystal is shown to be approximately an order of magnitude above the plasticity of an FL-I crystal. Cracking with respect to planes (110) was observed in the mark FL-V crystal. Figures 4; tables 1; references 8: 7 Russian, 1 Western.

UDC 621.3.049.75:655.226.2.019

INTERCONNECTION RELIABILITY IN PRINTED CIRCUIT DESIGN

Moscow ELEKTROTEKHNIKA in Russian No 1, Jan 85 (manuscript received 07 May 84)  
pp 27-29

GOLACHEV, S.M., SLONIMSKIY, A.D., engineers, TIKHONOV, V.I., candidate of physical and mathematical sciences, and VIGDOROVICH, V.N., doctor of technical sciences. OVNIEM

[Abstract] A reliable technology is needed for producing printed circuit patterns with three conductors passing between the adjoining contact pads with a 2.5mm interval. Three conductor layout would significantly simplify computer aided design of the printed circuit pattern but the present technology cannot provide algorithms for laying out two conductors with 2.5 mm spacing over two layers. Three parameters can be reduced without the loss of reliability: the nominal margin band  $n = (a-d)/2$ , where  $a$  is the nominal dimension of the contact pad,  $d$  is the nominal diameter of the window; the width of the printed conductor; and the interval between the conductors. Problems concerning determination of the minimal margin band were examined and the feasibility was studied of optimizing the dimensions of the contact pad. It was suggested that the established minimum dimensions standards for the margin band around the printed circuit contact pads be increased to 100 micrometers from the existing 80 micrometers to satisfy the GOST 23752-79 requirements for the printed circuit life-time. Use of dielectrics with a foil thickness of 5 micrometers would increase the wiring density without affecting the reliability of contacts and offer several other engineering advantages. Figures 3; references 7: 5 Russian, 2 Western.

[I92-12755]



## MICROELECTRONIC PULSE TECHNIQUES

Kiev, IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 12, Dec 84 p 91

D'YAKONOV, V.P., Head of the department of industrial electronics, Smolensk branch of Moscow Institute of Energy, doctor of technical sciences.

[Abstract] This is a review of "Handbook of Microelectronic Pulse Techniques" by V. N. Yakovlev et al. (Kiev, Tekhnika, 1983). Extensive material is collected in the published handbook for the design of pulse devices with integrated microcircuits. To the authors' credit, they introduced a generalized criterion of the pulse devices' efficiency, which is used for their comparison. There is a short description of the types of mass-produced microcircuits, together with their parameters, which are essential for application in pulse devices. Several specialized pulsed microcircuits are then described, such as multivibrators with differential, and operational amplifiers, with various types of logic microcircuits with integrated flip-flops and optrons. A total of about 170 pulse device circuits are included along with methods that can be used for their design. A detailed description of a new class of pulse instruments using charge coupled devices and regulated capacitors with large scale integration is published for the first time and the area of their application with digital filter technology is also indicated. The handbook is encyclopedic in terms of the microcircuit application in pulse devices; but, unfortunately, some promising types of pulse instruments were not included, i.e., K155AG1 and K155G3 multivibrators with transistor-transistor logic, and pulse devices in integrated comparators, function generators, etc. Little attention is devoted to the multifunctional class of microelectronic pulse devices such as integrated timers, although they are good prospects for replacing most with logic microcircuits and integrated operational amplifiers. The book contains very valuable information for the designers of modern pulse instruments.

[191-12755/

UDC: 621.396

## METHODOLOGY FOR ON-LINE TESTING AND ANALYSIS OF INTEGRATED CIRCUIT TECHNOLOGY BY ELECTRICAL TEST COMPONENTS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 6, Nov-Dec 84 (manuscript received 9 Feb 84) pp 539-545

PANASYUK, V.N., MOKEROV, V.G., OVCHARENKO, Ye.N., AMELIN, V.P. and KUZIN, S.M.

[Abstract] An approach to testing and analyzing integrated circuit technology is proposed in which test components are used to find the distributions of the parameters of the physical structure from the area of the wafer and crystals, represented in the form of response surfaces, followed by integral estimation. The use of two types of test cells is described: for investigating the response surfaces on working plates, comparing them with

charts of the position of good circuits and identifying the causes for rejected articles, and for investigating individual technological operations in order to construct models of the relationships between the distributions of the physical structure and the technological parameters. These test cells are used for certifying technological processes and equipment. The method makes it possible to optimize the technological process of integrated circuit production, including the implementation of objective testing, establish the relationship between the parameters of the physical structure and technical parameters, compare the statistical distributions of the parameters of the physical structure of good and bad circuits, and calculate the good area of the wafer from the parameters of the physical structure. References 6: 3 Russian, 3 Western.

/I99-6900/

UDC: 621.382

METHOD FOR INVESTIGATING ELECTRICALLY ACTIVE DEFECTS NEAR SURFACE OF SEMICONDUCTOR USING CHARGE-COUPLED DEVICE

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 6, Nov-Dec 84 (manuscript received 9 Feb 84) pp 546-550

FROLOV, O.S., PEREVERTAYLO, V.L., MAKSIMENKO, Z.I. and MEDVEDEV, Yu.P.

/Abstract/ Single defects in silicon are investigated with the help of surface charge-coupled devices. The method employed allows measurement to be conducted on a large number of cells simultaneously, with the area of each measured cell being less than  $10^{-5}\text{cm}^2$ . The sensitivity of the method to the defect currents is determined by the background current. Accumulation of the generation charge in CCD networks makes it possible to measure effectively the generation parameters of individual defects in silicon, to study the nature of the electrical activity of defects and their distribution over the surface of the crystal, and to assess the quality of MIS devices and technology for manufacturing them. References 6: 2 Russian, 4 Western.

/I99-6900/

ANALYSIS OF STATUS AND PROSPECTS FOR IMPROVEMENT OF SENSORS FOR MEASURING  
PARAMETERS OF TECHNOLOGICAL PROCESSES IN THE PRODUCTION OF INTEGRATED  
MICROCIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 6, Nov-Dec 84 (manuscript  
received 9 Feb 84) pp 551-557

KARTSEV, Ye.A., Moscow Institute of Electronic Machine Building.

[Abstract] The error level of commonly used sensors for various physical quantities is analyzed. Comparisons are drawn between pendulum, tuning fork, string, rod, quartz and thin shell resonators. It is found that string-type sensors are most accurate for technological tasks in microelectronics. The fundamental unit error of most sensors for measuring mechanical and thermal quantities is 0.25%; the error of string sensors that have been developed for vacuumetric pressure and the flow rate of gaseous media is found to conform to standard means of measurement. Possible ways of enhancing the accuracy of string sensors are outlined. References 12 Russian.  
[199-6900]

UDC 621.391.272

DIGITAL MODELING OF KALMAN-BUCY FILTER AND AN OPTIMUM FILTER DURING DISCRETE ARRIVAL OF INFORMATION

Moscow AVTOMATIKA I TELEMEXHANIKA in Russian No 1, Jan 85 (manuscript received 1 Dec 83) pp 59-68

MIL'SHTEYN, G.N. and P'YANZIN, S.A., Sverdlovsk

[Abstract] The problem is considered of digital modeling of a Kalman-Bucy filter for a continuous system when the arriving information is processed and utilized at a discrete moment of time. The following items are examined: 1) Quantification of system and optimum filter during discrete arrival of information; 2) Introduction of integrating unit for an increase of precision of digital modeling; 3) Recommendations with respect to choice of spacing of quantization. Comparison of various methods of digital modeling; and 4) Numerical integration of linear systems with additive noise. Figures 1; tables 2; references 14: 10 Russian, 4 Western (1 in Russian translation).

UDC 681.326.7

STRUCTURE OF MULTI-CHANNEL SIGNATURE ANALYZERS

Moscow AVTOMATIKA I TELEMEXHANIKA in Russian No 1, Jan 85 (manuscript received 25 Nov 83) pp 127-132

YARMOLIK, V.N., Minsk

[Abstract] The author states that the "effectiveness of use of a Hewlett-Packard signature analyzer is limited by the presence in such an analyzer of only one information input at a time the number of outputs of complex digital units attains a considerable magnitude." As a consequence of this, the creation of a highly effective signature analyzer for multi-output digital units is highly urgent. This paper offers a solution to the problem of constructing multi-channel signal analyzers for an arbitrary number of channels and any primitive and irreducible generation of the polynomial  $Q(x)$ . Figures 3; tables 3; references 13: 8 Russian, 5 non-Russian.

UDC: 621.372

CALCULATION OF TRANSIENT PROCESSES BY STEP SERIES METHOD ON PROGRAMMABLE CALCULATOR

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 21 Jun 84) pp 54-56

GAVRILOV, L.P. and KATKOV, I.V.

[Abstract] An algorithm and a program are developed for solving the system of nonlinear differential equations in normal form  $C(x)\dot{x} = Ax + f$  as an example of the recursive step-series calculation of transient processes. A program listing is presented for a calculator employing YaMK34 input language, such as the Elektronika B3-34. Each step takes 65 - 85 seconds to calculate. References 3 Russian.

[204-6900]

UDC: 621.396.964

APPROXIMATE ANALYSIS OF PULSE TRACKING SYSTEMS IN PRESENCE OF RANDOM INTERFERENCE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 21 May 84 after revision) pp 63-65

OBREZKOV, G.V. and SIZYAKOV, Yu.A.

[Abstract] An approximate method is presented for analyzing tracking systems that operate in a pulse (discontinuous) condition because of the discontinuous nature of the received signal. An approximate method is presented for calculating the variance of the tracking error. Computer modeling shows that the formula derived yields error of approximately 10%. References 4 Russian.

[204-6900]

UDC: 621.391.1.019.4

NOISE TOLERANCE OF RADIOTECHNICAL SYSTEMS WITH AMBIGUOUS OBSERVATION THRESHOLD

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 27 Jan 84) pp 65-67

BORISOV, E.V.

[Abstract] This study investigates the use of fuzzy sets to determine the observation threshold in a radiotechnical system in which a large number

of undetermined factors operate. The observation threshold is assigned as a fuzzy set, so that the average error probability becomes a function of a fuzzy variable and is also represented by a fuzzy set. The problem of estimating the noise tolerance of the system is solved by the axiomatic rules for functional transformations in fuzzy set theory. A similar approach can be used to estimate the possible variance of the average error probability in a particular system, and to define the accuracy requirements for the setting of the observation threshold. References 3 Russian.  
[204-6900/

UDC: 621.372.54

#### GENERALIZED METHOD FOR SYNTHESIZING BANDPASS FILTERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 4 Jun 84 after revision) pp 3-8

DZHAPARIDZE, V.P.

[Abstract] A method is presented for solving the equal-wave approximation problem of synthesizing bandpass filters that does not require that a low frequency prototype be found in advance. The method assumes that the nulls of the gain can reside on the coordinate axes, or can consist of complex-conjugate pairs residing in any part of the complex frequency plane. The approximated amplitude-frequency characteristic can be asymmetrical and can exhibit different attenuation levels in the upper and lower attenuation bands. The expression for the attenuation of elliptical filters is based on Zolotarev fractions, which can be viewed as a special case of a Chebyshev fraction; this means that the methods for solving approximation problems of Chebyshev and elliptical filters are special cases of the synthesis method described. The method is advantageous in that the solution is sought within a rectangle of finite dimensions on the plane W. References 3: 2 Russian, 1 Western.  
[204-6900/

UDC: 389.14:006.015:5:621.3.019

#### SYSTEMIZATION OF PROCEDURES FOR ASSESSING INTEGRATED MICROCIRCUIT TESTING ACCURACY

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 6, Nov-Dec 84 (manuscript received 9 Feb 84) pp 505-517

BONDAREVSKIY, A.S.

[Abstract] This study presents the accuracy characteristics of test devices and describes the method by which they are determined experimentally.

The connection between the a priori, a posteriori and unconditional supplier and customer risks with single-parameter and multiple testing are analyzed. The procedures described form a system that makes it possible to connect the distinguishing features of the technical implementation of test devices with the accuracy characteristics of single-parameter and more complex types of testing. Taken together, the procedures represent the basis of a general method for assessing testing accuracy in the mass production of various articles, including integrated circuits. References 20: 19 Russian, 1 Western.  
/I99-69007

UDC: 621.382

UNSTEADY PROCESSES IN ANALOG-DIGITAL CONVERTERS AND THEIR INFLUENCE ON  
DYNAMIC ERRORS OF INFORMATION-MEASUREMENT SYSTEMS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 6, Nov-Dec 84 (manuscript received 9 Feb 84) pp 525-528

SERGEYENKO, V.S. and TARATYNOV, V.S.

/Abstract/ Methods for changing the influence of the error due to component inertia and error due to fluctuation in the input signal on system performance are investigated under the assumption that the accuracy indicator is smaller than the acceptable value for the solution of a specific problem by the system. The error caused by external influences on the combined error of an angle-to-code conversion system is examined, using an alternating voltage - code converter as an example. It is concluded that automated testing and control systems can be used to test the parameters of LSI circuits and to control their characteristics. Elimination of the influence of unsteady processes on the characteristics of integrated circuits helps to reduce measurement system error. References 4 Russian.  
/I99-69007

UDC: 535.241.13:534-8

CALCULATION OF BANDWIDTH OF ACOUSTOOPTICAL MODULATOR WITH CYLINDRICAL  
PIEZOTRANSDUCER

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 28, No 1, Jan 85 (manuscript received 13 Mar 84 after revision)  
pp 76-78

ZADORIN, A.S. and SHARANGOVICH, S.N.

[Abstract] A method is presented for the engineering calculation of the bandwidth of acoustooptical modulators in which a cylindrical acoustic lens with a limited aperture is used to increase the divergence of the acoustic wave. The angular spectrum of the acoustic wave formed by the focusing surface are analyzed. The findings make it possible to determine the dimensions of the cylindrical transducer that provides a given modulator bandwidth. A lithium niobate modulator incorporating a cylindrical piezotransducer operating at 400 - 650 MHz is described. The experimental and calculated diffraction efficiency are found to agree well. References 4: 3 Russian, 1 Western.

[204-6900]

UDC: 621.396.6

ALGORITHMIC CONSTRUCTION OF MEASUREMENT SCALES FOR DIGITAL SIGNAL PROCESSING

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 6, Nov-Dec 84 (manuscript received 9 Feb 84) pp 493-504

ARUTYUNOV, P.A., Moscow Institute of Electronic Machine Building.

[Abstract] This study explains the application of digital algorithmic measurement in signal processing. Digital algorithmic measurement is based on the verification of equivalence relationships, and incorporates three measurement procedures: formation of the property to be compared, comparison of the properties and computation of the properties, the last of which is based on a digital measurement scale. The concepts of scale medium and scale structure are presented and explained. The development of parallel computation for algorithmic measurements is discussed. References 39 Russian.

[199-6900]



UDC 389.141:539.1/100

INTRODUCTION OF INTERNATIONAL SYSTEM OF UNITS IN AREA OF IONIZING RADIATION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, pp 4-6

ISAYEV. B.M.

[Abstract] The individual points of the 1984 methodical instructions for the implementation and use of physical quantities in the area of ionizing radiation established by Gost 8.417 - 81 are analyzed in detail. The units of energy, mass and time employed for ionizing radiation are outlined. The instructions specify and extend the requirements of the basic regulatory document (GOST 8.417 - 81, RD50-160 - 79) regarding the use of ionizing radiation in various applications. The introduction of SI units in the area of ionizing radiation will require the reworking of certain technical materials, methods for calibrating dosimetric equipment and other projects that must be carried out during the transitional period.

[226-6900]

UDC 681.3.087.92:519.26

PREDICTION OF RELIABILITY OF SHAFT POSITION-TO-DIGITAL CONVERTER BY DIFFERENTIAL EQUATION METHOD

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, pp 8-10

DOMRACHEV, V.G., ISAYEV, V.M. and MEYKO, V.S.

[Abstract] A quick differential equation method is proposed for estimating and predicting the reliability indicators of shaft position-to-digital converters. The determining parameters selected are the code accuracy and the code error probability for an established information capacity. The first of these establishes the confidence level of the measurement system, and is a function of the conversion error probability distribution; the second, which determines the possibility of significant deformation, is a function of the range of variation of the values of the error. The failure-free operating time is predicted by establishing the principles by which

these parameters vary and establishing the acceptable level to which they can be permitted to drop. A one-time study of the change in functional capabilities over time for an entire class of converters makes it possible to make a quick reliability estimate for each particular specimen with acceptable accuracy. References 4 Russian.

/226-6900/

UDC 681.5:65.015.13/084.2

#### CERTIFICATE FOR MEASUREMENT CHANNEL OF INFORMATION-MEASUREMENT SYSTEM

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85 pp 17-18

VODOP'YANOV, V.A., KAZAKOV, A.I., BRAILOV, E.S. and KONDRASHKOVA, G.A.

/Abstract/ This article describes the development of the measurement channel certificate, which contains the technical channel data guaranteed to the customer (user). A general schema for such certificates is developed that contains four basic sections: general information and technical data; normative and reference information associated with the characteristics of the conversion function and the variation in the measurement limits of the informative parameter; the dates and results of departmental and state tests (or the metrological certification); and the circuits of the information channel. The use of the proposed certificates will make it possible to monitor the metrological properties of information channels, to increase the accuracy of measurement information and to save significant amounts of time in the installation and technical maintenance of automatic control systems. References 2 Russian.

/226-6900/

UDC 62-791.8-52:62-229

#### ERRORS OF PHOTOELECTRIC DEVICES FOR AUTOMATIC SORTING OF PARTS BY SIZE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85 pp 19-20

SOROCHKIN, B.M.

/Abstract/ This study investigates the errors that occur when photoelectric converters are connected to automatic sorting devices. The resulting errors are determined primarily by the threshold device that converts the photodetector output signal to the signal indicating the sorting group number. The greatest error is that caused by the difference in the triggering currents of the actuating assemblies, which can be as high as 8 or 9%. This figure can be reduced by arranging the actuating assemblies in order of increasing or decreasing triggering current. A threshold circuit employing KT-315B transistors is described that provides high current gain. The use of the circuit in a multi-range part sorting device is described. References 5 Russian.

/226-6900/

SOME DISTINGUISHING FEATURES OF MEASUREMENT ASSURANCE FOR RADIO ISOTOPE THICKNESS METERS EMPLOYING MICROPROCESSORS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, pp 20-21

SOBOLEVSKIY, A.Ye. and TESNAVS, E.R.

[Abstract] The use of microprocessors in radio isotope thickness meters to provide self-calibration is described. Microprocessors employed in such capacities must keep track of the period between calibrations and automatically set the instrument to the calibration mode on schedule, control the automatic devices that implement the experimental parts of calibration operations, process the experimental data to estimate the tested parameters of the instrument, compare the estimates of the parameters checked with the established norms, decide whether the thickness meter is good or not, output a signal indicating the device ready for continued use, and print out a calibration certificate.

[226-6900]

PRECISION DISTANCE MEASUREMENT METHOD FOR INDUSTRIAL ROBOT SENSING SYSTEM

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, pp 22-23

KADASHOV, N.G.

[Abstract] A modified distance measurement method is described in which signals are emitted at different frequencies toward the object in question and the reflected signals are compared, and the spatial spectrum of the coherent radiation reflected from the surface, which is used as a reference, is registered, after which the emitted frequency is adjusted and the reflected spatial spectrum is compared with the reference. The relative frequency deviation corresponding to coincidence of the spatial spectra of the signal is then found and used to compute the sought difference. A device implementing the method is described that can be used for distance measurements over wide ranges with accuracy determined by the accuracy with which the frequency deviation of the radiation is measured. The proposed method can be used in industrial robots for object seeking and article testing. References 2 Russian.

[226-6900]

## DETERMINATION OF PARAMETERS OF DEVICES FOR AUTOMATIC TESTING OF SURFACE WAVINESS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, pp 24-26

BOGDANOV, V.P., PODSOSOV, Ye. V. and AFANAS'YEV, Ye.V.

[Abstract] An automatic device for measuring surface waviness is described in which the sensor is placed assymmetrically and the recorded signal is processed in the frequency domain. The method assumes that the harmonics that enter into the Fourier transform of the surface in question are of no interest; the Fourier transform of the surface is finite, i.e., there is a frequency  $f$  such that all harmonics with frequencies higher than  $f$  have zero amplitude. Because the base dimensions of the device are finite, the output signal is recorded over a length shorter than the total length of the tested surface. The device reconstructs the profile of the surface by exploiting the amplitude-frequency characteristic of the device and harmonic analysis of the output signal. Optimum positioning of the sensor is described. References 5 Russian.

[226-6900]

## MEANS FOR MEASURING STRUCTURAL CONSTANT OF ATMOSPHERIC INDEX OF REFRACTION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, pp 31-32

ISHMUKHAMEDOV, B.N., ZAKIROV, Sh.Kh., MIRZAYEV, A.T., SHARAKHIMOV, M.Sh. and SHAYAKHOV, R.F.

[Abstract] A device is proposed for measuring the structural constant of the atmospheric index of refraction that is based on measuring the fluctuations in intensity of the laser beam after it is passed through the medium in question. An expression for the structural constant of the index of refraction of air is derived by solving the wave equation for a plane wave using the smooth perturbation method for slight turbulence. The device implementing the method incorporates a dispersion meter combined with a laser range finder. Testing of the device on a sloping path under mountainous conditions is described. References 5 Russian.

[226-6900]

## ASSESSMENT OF STABILITY OF THERMAL ELECTRODE MATERIALS

Moscow IZMERITEL'NAYA TEKHNICA in Russian No 2, Feb 85, pp 41-43

PAVLOV, B.P., SERMYAGINA, L.P., KONSTANTINOVA, G.I. and ANDREYEVA, L.S.

[Abstract] The inhomogeneity distributions of pieces of wire made of chromium, Alumel, Cople, platinum alloys containing 6 and 30% rhodium, and tungsten alloy containing 5 and 20% rhenium annealed at various temperatures in the appropriate furnaces are investigated experimentally. The inhomogeneity curves of the materials are analyzed and compared. The findings indicate that it is possible in principle to investigate and assess the stability of thermal electrode materials by their inhomogeneity. It is recommended that the method be added to GOST 1790 - 77 and GOST 10821 - 75, as well as the technical specifications for thermal electrode materials. References 9 Russian.

[226-6900]

## JOSEPHSON VALUE OF FINE STRUCTURE CONSTANT

Moscow IZMERITEL'NAYA TEKHNICA in Russian No 2, Feb 85, pp 46-48

TUNINSKIY, V.S.

[Abstract] A refined Josephson value of the fine structure constant is derived from the results of measurements of atomic energy levels and anomalous magnetic electron moment performed at leading laboratories around the world. An estimate is obtained for the drift of the unit of resistance supported by the coils maintained by the International Bureau of Weights and Measures. References 13: 4 Russian, 9 Western.

[226-6900]

## SELECTION CRITERION FOR OPTIMUM FREQUENCY BAND FOR MONITORING PARAMETERS OF MULTILAYER DIELECTRIC STRUCTURES

Moscow IZMERITEL'NAYA TEKHNICA in Russian No 2, Feb 85, pp 48-50

SLAVIN, I.V.

[Abstract] This study proposed a criterion for constructing an experimental design in order to select the optimum frequency band for determining the

parameters of multilayer dielectric structures by parametric optimization. The experimental design assumes that the number of layers of the investigated structure is known, as well as the nominal parameters of the layers, the number of measurements, the set of microwave radiation frequencies, the angle of incidence of the electromagnetic wave on the surface of the specimen and the relationship between the measured coefficient of reflection of the dielectric structure, the independent variables, and the unknown parameters. The coefficient of reflection of a two-layer dielectric structure is modeled numerically. The curves plotted from the estimate and the curves calculated from the nominal parameters are quite similar; an interpretation is given for the difference observed in the relative estimate errors. References 7 Russian.

/226-6900/

UDC 621.376.3:621.374

#### AUTOMATION OF CALIBRATION AND CERTIFICATION OF FREQUENCY DEVIATION METERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85 pp 50-51

OGAR', V.I. and PAVLENKO, Yu.F.

[Abstract] This study describes a standard means of measurement based on the zero-order Bessel function, which exploits the properties of the spectral expansion of FM oscillation with harmonic modulation, and entails registering the disappearances of those spectral components which are proportional to  $n$ th-order Bessel functions of the first kind. Inasmuch as the roots of the Bessel function in question have been tabulated, and the frequency  $F$  is known quite precisely, the method makes it possible to obtain the spectrum of calibrated FM indices or frequency deviations. The cumbersome nature of the process, and the high skill level required of the operator, are alleviated by using digital techniques. The functional diagrams of devices implementing the procedure are presented. The devices speed measurement times by a factor of ten, and can be used in various measurement instruments employing FM and modulation measurement methods. References 6 Russian.

/226-6900/

UDC 621.38.019.3:389.14

#### L2-22 INSTRUMENT CALIBRATION BENCH

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, p 64

IL'IN, V.V.

[Abstract] A bench developed for calibrating the L2-22 low-power transistor parameter measuring device is described. The device consists primarily of

a set of 0.5% resistors that are selected by a switch in accordance with the points on the scales being checked. The circuit diagram of the bench is presented and explained; jacks are provided for connecting a standard dc voltmeter, milliammeter, microammeter and frequency meter.

[226-6900]

UDC 621.38.019.3:389.14

#### DEVICE FOR CALIBRATING L2-41 IC TESTERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 85, p 65

CHEKIN, N.I.

[Abstract] A device is described for calibrating L2-41 integrated circuits. The IC to be tested is connected to the device, along with a voltmeter, milliammeter and dc power source. The circuit test sequence is then executed by means of switches on the calibrator. The schematic diagram of the device is presented and explained. The operation of the device, which itself requires no calibration, is described.

[226-6900]

#### VIBRATION DISPLACEMENT METER

Moscow RADIO in Russian No 12, Dec 85 pp 22-24

A. DUGIN, Moscow.

[Abstract] This article describes a device for precise measurement of the linear displacement of the vibrating portion of a mechanism, such as the table of a vibration bench. The instrument works by registering changes in the capacitance of a vibration sensor that is secured mechanically to the vibrating section. Variation in the capacitance of the sensor changes the frequency of an HF oscillator. A frequency detector converts the frequency change to a voltage change that is proportional to the vibration displacement measured. The schematic diagram, PC board foil pattern and cabinet design of the instrument are presented, and the basic technical specifications are tabulated. The operation of the sensor, which consists of a coaxial variable capacitor and an electronic module, is described. All of the components of the electronic module are mounted on a PC board 1mm thick. The instrument is powered from a 220 V line through a built-in bipolar stabilized power supply.

[205-6900]

METROLOGICAL PROBLEMS OF MICROELECTRONICS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 6, Nov-Dec 84 (manuscript received 9 Feb 84) pp 484-492

SRETENSKIY, V.N.

[Abstract] The application of the basic principles of metrology for mass and high-precision measurements in modern microelectronics is investigated. The primary tasks of metrological support in microelectronics are discussed. A classification is provided for the objects of measurement and testing in microelectronics. The measurement accuracy required for VLSI technology is discussed and a number of fundamental metrological problems facing microelectronics, the solution of which will promote overall development of microelectronics, are outlined. References 60 Russian.

[I99-6900]



INCREASING ACCURACY OF RADAR MEASUREMENTS OF SEA ICE THICKNESS BY CEPSTRAL PROCESSING ["KEPSTRAL'NAYA OBRABOTKA"] OF RETURNS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript submitted 25 Mar 83), pp 291-297

[Article by V.V. Bogorodskiy, V.I. Boyarskiy, and A.G. Oganessian: "Increasing Accuracy of Radar Measurements of Sea Ice Thickness by Cepstral Processing ["Kepstral'naya Obrabotka"] of Returns"]

[Text] It has been suggested to use Cepstral methods ["kepstral'nyye metody"] of processing returns from ice to increase the accuracy of existing methods for remote measurement of sea ice thickness using radar. The promise of these methods was shown in an example of returns obtained using a digital simulator (the expected root-mean-square [rms] measurement error of sea ice thickness from 0.1 to 2.0 m is 6%). Using algorithms that were developed, radar signals obtained at the "Severnnyy Polyus-24" drifting station and during flights over the Arctic ice were analyzed (rms error of ice thickness measurements did not exceed 10%).

Measuring the thickness of sea ice (to 2 m) by radar techniques is tied to the need for time sharing of returns from the upper and lower edges of the ice. Most works, references 1-3 for example, are concerned with radar meters having direct observation of the return on an oscilloscope. The transmitted signal must be short enough so that the operator can clearly distinguish reflections from the upper and lower edges of the ice on the screen. The operator participation required is a significant drawback of such a meter. Of course, measurement errors in this case depend on his training and experience.

For all practical purposes, 15-20 cm is the minimum ice thickness necessary for radar measurement, which requires use of 2-3 ns pulses. Such signals can be implemented in the upper portion of the decimeter and in the centimeter bands, however, in these ranges sea ice becomes partially or completely transparent.

When measuring the thickness of sea ice, the radar operates by faces of resolution, therefore the operator has to determine the mutual delay of reflections by indirect indications, for example by the increase in signal duration and appearance of additional maximums in the return, interpreted as signals

from the lower edge of the ice, etc. All of this brings a subjectivism to the measurement process and does not permit it to be automated.

The alternative to existing processing methods are those based on digital inverse filtering of the return, in particular Cepstral methods, making it possible to separate the transmitted and return signals, under specific conditions, when there is no Rayleigh time resolution between them. Figure 1a [4, 5] shows a generalized block diagram of the device performing the Cepstral processing ["kepstral'nuyu obrabotku"] of the signals.

During subsurface radio sounding, the return at the receiver output is a composite of transmitted signals with pulse characteristics of the probed medium and the receiver-amplifier path. The end goal of Cepstral processing ["kepstral'noy obrabotki"] is extraction of the pulse characteristics of the probed medium carrying information about the delay time between signal returns from its edges. For this, the following operations are carried out sequentially according to the block diagram (see Figure 1a): analog-to-digital conversion of returns, digital Fourier transform, calculation of the modulus of the return spectrum, logarithmic operation, cancellation of the transmitted signal spectrum, antilogarithm-taking operations for restoration of the difference in magnitudes of spectral functions of the return and transmitted signals approximating the spectral function of the pulse characteristics of the probed medium, and inverse digital Fourier transform. As a result of which, the cepstrum ["kepstr"] of the pulse characteristics of the probed medium are obtained, where the position of the first time maximum from the zero axis corresponds to the delay of the return.

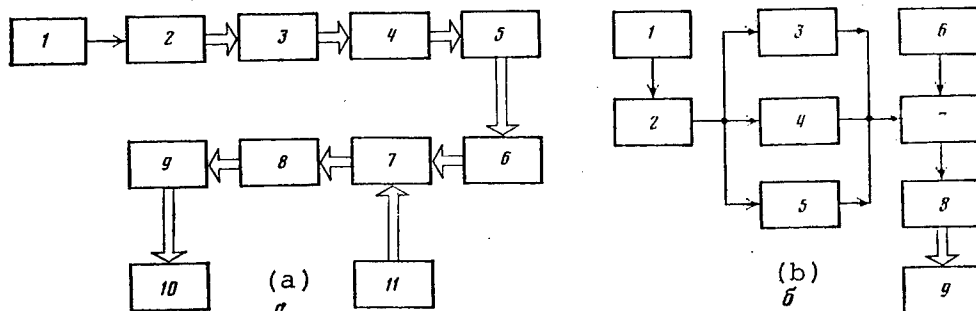


Figure 1. Simplified block diagram of the special processor for Cepstral processing ["kepstral'noy obrabotki"] of radar signals

Key:

a.

b.

1. Radar receiver
2. Analog-to-digital converter

1. Transmit signal digital simulator
2. Digital Fourier transform

- |                                                                                 |                                                                                        |
|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 3. Main storage unit                                                            | 3. Filter for components of the straight-through signal                                |
| 4. Digital Fourier transform                                                    | 4. Filter for components of signal from upper edge of ice                              |
| 5. Calculation of magnitude of spectrum                                         | 5. Filter for components of signal from the lower edge of ice                          |
| 6. Logarithm taking of magnitude of the spectrum                                | 6. Noise generator                                                                     |
| 7. Subtraction unit                                                             | 7. Receiver-amplifier path filter                                                      |
| 8. Antilogarithm taking of the difference of logarithms of the spectra          | 8. Inverse digital Fourier transform                                                   |
| 9. Inverse digital Fourier transform                                            | 9. Special processor for Cepstral processing ["spetsprotessor kepstral'noy obrabotki"] |
| 10. Read-out generation unit                                                    |                                                                                        |
| 11. Transmit signal storage unit; Devices modeling signals reflected by the ice |                                                                                        |

Model experiments using a digital signal simulator and a packet of programs implementing the Cepstral processing algorithm ["algorithm kepstral'noy obrabotki"] were proposed to evaluate the capabilities of the Cepstral method ["kepstral'nogo metoda"] for processing returns from sea ice. Figure 1b shows a block diagram of a model experiment. The following were researched as transmitted signals:

linear-exponential pulse type:

$$(1) \quad X(i\tau) = \frac{i\tau}{64} \exp(-0,105i\tau)$$

linear-exponential radio pulse type:

$$(2) \quad X(i\tau) = [1 - \exp(0,105i\tau)] \exp(-0,105i\tau) \sin(0,5i\tau),$$

where:  $\tau$  is the period of time sampling of transmitted signals, 0.24 ns in the model experiments;  $i = 0, 1, 2, 3, \dots, N$  is the number of sampling points within the width of the transmitted signal ( $N = 64$  in model experiments).

Signals of types (1) and (2) are some of the most suitable for Cepstral analysis ["kepstral'nogo analiza"], since their cepstrum ["kepstr"] is a smooth, rapidly diminishing function of time, concentrated close to the zero time axis, which facilitates separating the transmitted signals and returns in the Cepstral region ["v kepstral'noy oblasti"] [6]. In addition, similar signals best model signals used in radiosounding of sea ice from the surface (1) and from an aircraft (2). Figure 2 shows the shape of time functions modeling transmitted signals. In modeling the return from the ice (Figure 1b), it was considered that the signal contains three components: the

straight-through signal, and returns from the upper and lower edges of the ice.

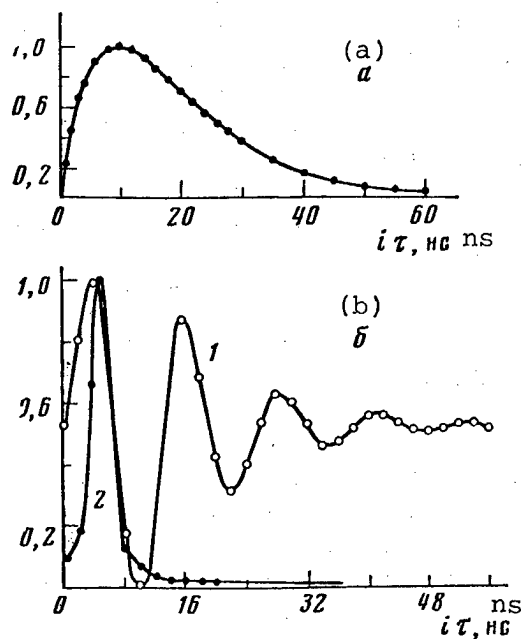


Figure 2. Time functions modeling transmitted signals

Key:

- a. video pulse
- b. radio pulse
  - 1 - signal shape
  - 2 - modulus of its spectrum

The spectral function of the corresponding components of the modeled signal are determined by filtering the spectral functions of transmitted signals (1) and (2) by filters with frequency characteristics of the type

$$(3) \quad K_n(n\Omega) = 10^{-a/10} \exp\left(-j \frac{l\Omega}{C} n\right)$$

for components resulting from the signal modeling straight-through passage;

$$(4) \quad K_n(n\Omega) = \frac{1 - \sqrt{\epsilon_n'(n\Omega)}}{1 + \sqrt{\epsilon_n'(n\Omega)}} \exp\left(-j \frac{2h\Omega}{C} n\right)$$

for components resulting from the signal modeling the return from the upper edge of the ice;

$$(5) \quad K_n(n\Omega) = \left[ 1 - \left( \frac{1 - \sqrt{\epsilon_n'(n\Omega)}}{1 + \sqrt{\epsilon_n'(n\Omega)}} \right)^2 \right] \frac{\sqrt{\epsilon_n'(n\Omega)} - \sqrt{\epsilon_n'(n\Omega)}}{\sqrt{\epsilon_n'(n\Omega)} + \sqrt{\epsilon_n'(n\Omega)}} \times \\ \times 10^{2G(n\Omega)d/10} \exp \left[ -j \frac{2\Omega}{C} \left( h + d \sqrt{\epsilon_n'(n\Omega)} \right) n \right]$$

for components resulting from the signal modeling the return from the lower edge of the ice, where:  $n = 0, 1, 2, 3, \dots, 31$  is the number of the harmonic in the spectrum of digitized transmitted signals (1) and (2);  $\Omega$  is the frequency interval between harmonics in the transmitted signal spectrum;  $q$  is the discrimination between receive and transmit antennas, dB;  $l$  is the spacing between antennas, m;  $C$  is the electrodynamic constant;  $\epsilon_n'(n\Omega)$  is the real part of the complete relative dielectric constant of sea ice at frequency  $n\Omega$ ;  $h$  is the height of the antenna above the ice, m;  $\epsilon_n'(n\Omega)$  is the real part of the complete relative dielectric constant of sea water at frequency  $n\Omega$ ;  $G(n\Omega)$  is the specific absorption of electromagnetic energy in ice at frequency  $n\Omega$  (dB/m);  $d$  = ice thickness, m.

To calculate the shape of the resulting signal undergoing further processing, the outputs of filters (3), (4), and (5) were combined with the input of the filter modeling the radar receiver-amplifier path. After the appropriate conversion, noise sent by a random number generator was input to this filter. After the inverse digital Fourier transform, the output signal of the filter was a time function modeling the return from the ice. For modeling different radiosounding situations, parameters were changed, such as: ice thickness, height of antennas, discrimination between antennas, and noise level. Table 1 shows the real part of the complex permeability and specific absorption as a function of frequency, obtained by correlation of existing literary data by electrical constants of sea ice [2, 7]. Linear interpolation was used to determine  $\epsilon_n'$  and  $G$  between points of the table.

(1) Частота, МГц	(2) Удельное поглощение, дБ/м	(3) Диэлектрическая про- ницаемость льда
1	0,42	10,0
10	0,50	5,8
100	1,08	3,6
200	2,58	3,2
300	6,67	2,6
400	13,6	2,5

Table 1

Key:

1. Frequency, MHz
2. Specific absorption, dB/m
3. Dielectric constant of ice

Figure 3 shows time functions modeling reflections at different ice thicknesses and representations of the transmitted signal in shape (1). As follows from Figure 3, the shape of these time functions significantly depends on such parameters of the model as  $G(n\Omega)$  and  $\epsilon_{\pi}'(n\Omega)$ , describing the electric properties of the ice. In the case of  $G(n\Omega) = 0$ ,

$$\epsilon_{\pi}'(n\Omega) = \text{const} = 3.2,$$

(i.e. when there is an absence of absorption and dispersion, which is characteristic for fresh water ice in the radiosounding frequency band), reflections hold the shape of the sounding signal, changing only in amplitude and delay as the ice thickness increases, and at thicknesses greater than 0.3 m (with a selected transmitted signal model) signals from the upper and lower edges of the ice are well discernible (Figure 3a).

A different picture is seen if  $G(n\Omega)$  and  $\epsilon_{\pi}'(n\Omega)$  are unstable in the band of frequencies occupied by the transmitted signal spectrum. Figure 3b shows the results of modeling returns during changes in the specified parameters in accordance with Table 1, from which it is evident that changes in the time shift between signals reflected from the edges of the ice, in the form of a time function of the reflected signal (in reality, by its oscillogram), are impossible due to the lack of time resolution at thicknesses less than 0.5 m.

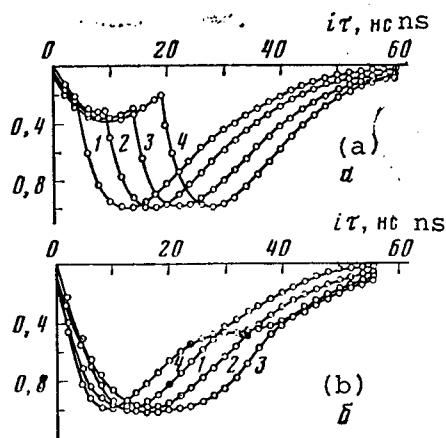


Figure 3. Time functions modeling returns

Key:

- a. From fresh water ice

b. From salt water ice  
Ice thickness: 1 - 0.1 m; 2 - 0.2 m; 3 - 0.3 m; 4 - 0.4 m  
Height of antennas: 0 m  
Discrimination between antennas: 100 dB  
Signal-to-noise ratio: 40 dB

An experienced operator observing such a signal can approximately determine ice thickness, for example, by the increase in the duration of the return. However, a similar method does not provide a solution to the problem of automatic diagnosis of the thickness of sea ice over the entire range of change required.

As the modeling experiments with a sea ice radar return digital simulator showed, it is possible to solve the problem at hand using the Cepstral method ["kepstral'nyy metod"] for processing returns. The returns shown as time functions (Figure 3) were processed according to the block diagrams shown in Figure 1. Selection of the frequency characteristics of the filter separating the spectral functions of the transmitted signal and pulse characteristics of the ice is an important feature of Cepstral processing ["kepstral'noy obrabotki"], especially at low time delays of returns (i.e. small ice thicknesses).

Use of a filter with frequency characteristics inverse to the transmitted signal spectrum yielded the best results. Figures 4 and 5 illustrate the effectiveness of processing cepstra ["kepstroy"] of time functions of types 3a and 3b by such a filter, where cepstra ["kepstry"] are shown before (Figures 4a and 5a) and after (Figures 4b and 5b) filtering. It is evident from Figures 4 and 5 that the presence of frequency-dependent energy absorption in the frequency band occupied by the transmitted signal in sea ice causes a widening of the Cepstral spikes ["pikov kepstra"] of the pulse characteristics of the sea ice (Figure 5b), which reduces the accuracy of the reading, as compared with fresh water ice (Figure 4b). The method used makes it possible, using an uncomplicated system for generating readings, to determine the Cepstral maximums ["maksimumy kepstra"] of pulse characteristics and their time position, and by it, the return delay.

Statistical processing of the results of over 500 modeling experiments with digital simulator signals (1) and (2), during changes in the signal-to-noise ratio between 10-50 dB, height of antennas between 0-3,000 m, discrimination between antennas between 40-120 dB, and changes in the parameter of model d between 0.1-2 m made it possible to estimate the error of measuring the time interval by the Cepstral method ["kepstral'nyy metod"] (Table 2). The corresponding values for fresh water ice are shown in parentheses ( $G(n\Omega) = 0$ ;  $\varepsilon_n'(n\Omega) = \text{const} = 3,2$ ). The value of one reading with time sampling of signals was 0.24 ns, and this value was included in the measurement error.

Radar signals received during contact radiosounding of sea ice under actual conditions at the Severnyy Polyus-24 drifting station were subjected to Cepstral processing ["kepstral'noy obrabotke"] [7]. Radiosounding of the ice

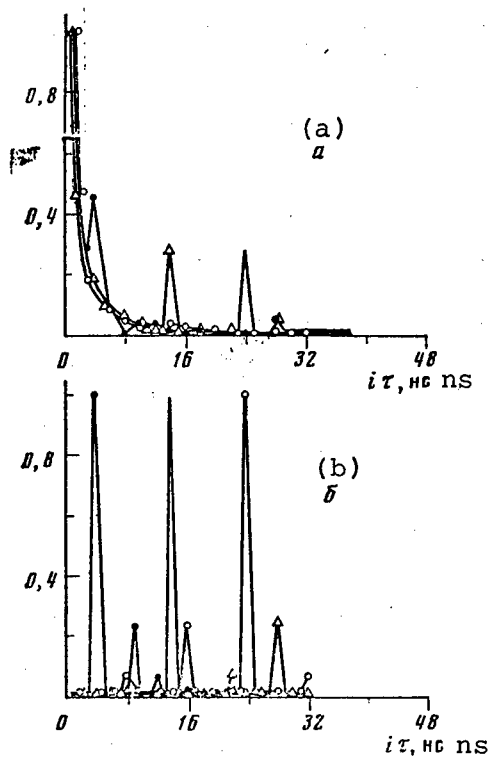


Figure 4

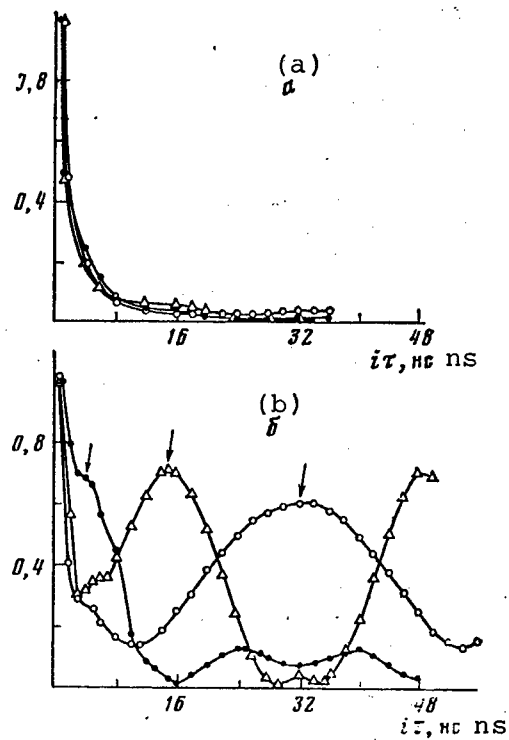


Figure 5

Figure 4. Cepstra ["Kepstry"] of time functions modeling returns from fresh water ice

Key:

Thickness:

Dot - 0.1 m

Triangle - 0.2 m

Circle - 0.5 m

a. Without filtering

b. After filtering (height of antennas - 0 m, discrimination between antennas - 100 dB, signal-to-noise ratio - 40 dB)

Figure 5. Cepstra of time functions modeling returns from salt water ice



Key:

Thickness:

Dot - 0.1 m

Triangle - 0.3 m

Circle - 0.5 m

a. Without filtering

b. After filtering

Arrows show reading points of the time delay of the return from the lower edge of the ice (height of antennas - 0 m, discrimination between antennas - 10 dB, signal-to-noise ratio - 40 dB)

(1) Толщина слоя льда, м	(2) Систематическая погрешность, %	(3) Среднеквадратичная погрешность, %
0,1	25(0)	12(8)
0,2	21(0)	12(7)
0,3	13(0)	10(5)
0,4	14(0)	7(2)
0,5	12(0)	1(1)
1,0	11(0)	1(1)
1,5	10(0)	1(1)
2,0	10(0)	1(1)

Table 2

Key:

1. Ice thickness, m

2. Systematic error, %

3. Root-mean-square error, %

was conducted by the frozen double line method in the ice thickness range from 0.3 to 1.5 m. Transmitted signals representing a video pulse approximating the shape in (1) and ~5 ns in duration, and a type (2) 40 MHz radio pulse, were fed through a matching device to the double line, frozen vertically in the ice. After stroboscopic conversion, the returns from the ice were recorded on photographic film. Table 3 shows the results of ice thickness measurements in the full-scale experiment (l = 1.0 m, q = 0, signal-to-noise ratio 50 dB) using Cepstral processing ["kepstral'noy obrabotki"] of signals with video and radio pulse sounding. The last boxes of Table 3 show the average values of the rms errors in the range of thicknesses presented.

Error values shown in Table 3 were obtained on the basis of processing 50 oscillograms of returns (25 each from video and radio pulses). The oscillograms were shown in the form of 64 readings in an interval of 20 ns for a video pulse and 160 ns for a radio pulse, after which the cepstra ["kepstry"] of the signals were calculated and the ice thickness was estimated by the position of the second maximum relative to the beginning of the cepstra ["kepstra"]. As is evident from Table 3, the rms error of the change in

(1) Толщина слоя льда, см	(2) Систематическая погрешность, %		(5) Среднеквадратичная погрешность, %	
	(3) видео	(4) радио	видео	радио
37	37	-	7,7	9,3
45	28	4		
57	32	16		
72	24	34		
93	30	14		
106	29	25		
126	29	12		
153	26	17		

Table 3

Key:

1. Ice thickness, m
2. Systemic error, %
3. Video
4. Radio
5. Root-mean-square error, %

thickness of sea ice with an actual distribution of electrical properties, obtained on the basis of Cepstral analysis ["kepstral'nogo analiza"] of returns, does not exceed 10% in the thickness range from 0.35 to 1.5 m.

A significant feature of measurement using the cepstrum ["kepstra"] lies in the fact that signals from the upper and lower layers of ice expectedly were separated even when the ratio of their levels reached several tens of decibels (sufficient for the lower signal to be differentiated against the noise). Simulation experiments showed that at thicknesses up to 3 m the carrier frequency of the transmitted signal can be increased to 800 MHz, which makes it possible to use considerably smaller antennas.

Between February and April, 1983, experiments were conducted in radar sounding of sea ice of the East Arctic from aboard an IL-14 aircraft. The onboard transceiver made it possible to emit and receive sea ice returns of radio pulses at a carrier frequency of 100 MHz and ~70 ns duration. The signals received were recorded on a perforated tape using an analog-to-digital converter and perforator. Processing of returns from the landfast ice of Chaunskaya Guba showed that the rms deviation in ice thickness readings did not exceed 7%.

The following can be said in conclusion. Use of Cepstral processing ["kepstral'noy obrabotki"] of returns significantly increases the resolving power and accuracy of sea ice measurements. Measurement can be done from aboard an aircraft and is completely automated. High response speed analog-to-digital

converters and microprocessors can be used for this. The results of digital processing of the signals are stored and can be used and presented later in the required form.

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12304

CSO: 1860/221

UDC 621.371.33

METHOD OF CALCULATION OF EFFECTIVE FIELD INTENSITY DURING RADIO BROADCASTING IN SHORTWAVE BAND

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 13 Sept 83)  
pp 52-57

NIKONOV, G.I.

[Abstract] For use in an evaluation of the effectiveness of use of antennas, a method is proposed for calculation on an electronic coputer of the effective field intensity along the path of radio wave propagation, which makes it possible to take into consideration both large-scale as well as small-structure horizontal nonuniformities of the ionosphere. The following items are examined: 1) Calculation of distribution in space of discrete portions of radiation intensity; 2) Calculation of distribution of  $R_{ud}$  [ $\text{kW}/\text{km}^2$ ] along the propagation path; 3) Effect of attenuation, with permeating by radio waves of D and E layers, and with reflection from F2 layer of the ionosphere; 4) Effect of large-scale horizontal ionospheric inhomogeneities; and 5) Effect of small-structure horizontal ionospheric inhomogeneities. The author thanks N. Yu. Denisov who worked out a program for calculation of  $R_{ud}$  on an electronic computer (in Fortran language). Figures 6; tables 1; references: 6 Russian.

UDC 621.396.67

ZENITH ANTENNA ARRAYS OF PLANE RADIATORS

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 18 June 84)  
pp 60-62

BELOUSOV, S.P. and KLIGER, G.A.

[Abstract] Antennas for zenith radiation, constructed on a base of plane square radiators, are described. The method of excitation of the radiators provides radiation of two mutually orthogonal components of the electromagnetic field. The plane radiators can be used not only in zenith antennas but also in broadside antenna arrays. A block diagram of the unit is presented. Figures 7; references 2 Russian.

## PHASING ALGORITHMS FOR ANTENNA ARRAYS ADAPTIVE TO THEIR OWN STATE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 9 Jul 84) pp 12-19

GUSEVSKIY, V.I. and ISHMAMETOV, I.A. and LIDSKIY, E.A.

[Abstract] A method is described for constructing adaptive phasing algorithms for antenna arrays that employs aperture orthogonal polynomials. The method ensures accurate beam adjustment in the required directions when controllable distortions of the amplitude-phase distribution occur as the system operates. The construction of the corrective regions of T-plane square arrays is described. References 3 Russian.

[204-6900]

## SYNTHESIS OF OPTIMAL STOCHASTIC CONTROL ALGORITHM FOR WEIGHT AMPLIFIERS IN ADAPTIVE ANTENNA ARRAY

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 16 Jun 84 after revision) pp 57-59

POPOV, A.S.

[Abstract] An optimal stochastic control algorithm described by a system of recursive formulas is derived for the dynamic system represented by the weight amplifiers of an adaptive antenna array. A device is synthesized that generates an optimal directivity pattern that tracks 'instantaneous' changes (over the averaging interval) in the signal-interference situation. Modeling and analysis show that the algorithm is insensitive to differences between the values of the model parameters and the true parameters. References 5: 4 Russian, 1 Western.

[204-6900]

UDC 621.372.832

MULTICHANNEL MICROWAVE FREQUENCY DIVIDERS WITH DIELECTRIC RESONATORS

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 27, No 12, Dec 84 (manuscript received after revision 16 Apr 84) pp 62-65

VOYTENKO, A.G., GASSANOV, L.G., ZELYAVSKIY, V.B., and NARYTNIK, T.N.

[Abstract] Small-size microwave frequency dividers are needed for multi-channel transmit-receive devices used in communication systems and antenna feeder lines for simultaneous transmission and reception of signals over several frequency bands. One way to develop such frequency dividers is to employ miniature dielectric resonators, which are commonly used for filtering and frequency stabilization in a wide range. Four-channel frequency dividers using miniature dielectric resonators made of high quality thermostable ceramic material for operation in the centimeter waveband were developed and tested. The construction consisted of a metal case with four sections, one input and four output connectors, and several dielectric resonators. Each section represents an individual cell of a filter, containing a chain of dielectric resonators tuned to a specified frequency. The filters were designed by first determining the output parameters of a low frequency prototype of the filter, and then determining the filter size, the Q-factor of the elements and their coupling coefficients. Employment of the miniature dielectric resonators allowed development of small-size multi-channel frequency dividers without the application of ferrite decoupling devices. This reduced the losses in the channels and increased their thermal stability. Agreement between the computed and the experimental curves supported the validity of the selected electrophysical model of the individual parallel connected filters or dielectric resonators, and the computation method. The developed small-size ( $100 \times 50 \times 13 \text{ mm}^3$ ), four-channel frequency dividers can be used for combining or separating channels in various wideband transmission systems with a capacity of up to several tens of watts. Figures 2; references 10: 8 Russian, 1 Western, 1 translated

[I91-12755]

## MULTIDIODE POWER COMBINERS IN THE MILLIMETER RANGE (REVIEW)

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 27, No 12, Dec 84 (manuscript received 14 June 84) pp 4-21

ZARITSKAYA, Ye. A., KOTSERZHINSKIY, B.A., PERSHIN, N.A., TARANENKO, V.P.,  
and TKACHENKO, L.A.

[Abstract] Feasibility of further increasing microwave power using a single active element in the frequency range above 60 GHz is practically exhausted. Techniques are examined for combining solid state active elements and the present state-of-the-art is reviewed. Impact avalanche transit time diodes (IMPATT) and tunnel diodes (diodes with intervalley junction) are employed for designing amplifiers and oscillators in the millimeter range. Intensive studies of the feasibility of combining active elements in the millimeter range led to the development of three promising circuits for power addition: slotted line directional couplers, waveguide resonators and open resonators. Slotted line directional couplers are presently employed for power combining circuits at frequencies up to 100 GHz, using from one to two active elements in a single module connected in a bridge with 2 to 4 modules and an efficiency of about 80%. Power combining circuits with waveguide resonators can be used at frequencies up to 230 GHz. At frequencies of 41 GHz the number of active elements is 12, at 45 GHz is 8, at 92-140 GHz is 4, at 217 GHz the power of two IMPATT is combined. For frequencies above 100 GHz very large waveguides are employed. The efficiency in the 94 to 230 GHz range is about 80%. Power combining circuits can be realized with radial resonators for operation at frequencies up to 40 GHz. At this frequency the maximum number of diodes is 8, and the efficiency of the combination is 100%. Theoretically, it is possible to design multidiode devices at frequencies above 100 GHz using higher oscillation modes. Multichip structures are presently employed at a frequency of 40 GHz, but it is unlikely that diodes operating at frequencies above 100 GHz will ever be developed. For the shortwave band of the millimeter range the prospects are most promising for developing a combination system of active elements with open resonators. At the present time studies are focused at three centimeter and eight millimeter wavelengths, where work continues on perfecting the known devices as well as developing new ones. Figures 29; tables 4; references 43: 6 Russian, 37 Western.

[I91-12755]

MICROWAVE OSCILLATOR FOR THREE CENTIMETER WAVE BAND USING FIELD EFFECT TRANSISTOR AND STABILIZED BY A DIELECTRIC RESONATOR

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 12, Dec 84 (manuscript received after revision 25 Nov 83) pp 26-30

PROTOPOPOV, A.P. and CHEREPUKHIN, V.I.

[Abstract] Schottky barrier Ga As Field Effect Transistors, whose parameters at frequencies up to 20 GHz are superior to bipolar avalanche and tunnel diodes have a very promising future for application as active elements in microwave oscillators. Dielectric resonators are commonly used for the frequency stabilization of oscillators in place of cavity resonators, which make it possible to simplify the construction and to reduce the cost. A Ga As Schottky FET oscillator was constructed and tested for operation in the three centimeter band. A hybrid IC circuit provides for two different ways of coupling the dielectric resonator. A unipolar power supply can be used where the positive voltage is applied to the drain with grounded gate. The selection of the operating point is determined by the negative voltage between gate and source across the resistor in the source circuit. In this circuit the dielectric resonator acts as a discontinuity in a matched transmission line. At resonance a fraction of the incident power is reflected from the resonator back to the transistor, a fraction is absorbed in the dielectric resonator, and the remaining power is applied to the load. At resonance practically all power is supplied to the load. A circuit with the dielectric resonator at the output was also examined. The results of tests indicated that the above described oscillators stabilized by a dielectric resonators exhibit good energy characteristics. The oscillators have a relatively high frequency stability and the output power for a broad range of temperatures. This makes them suitable for use as heterodynes with unmanned communication systems of satellite television. Figures 3; references 7: 5 Russian, 2 Western.

[T91-12755]

COMPUTER AIDED DESIGN OF RELFEX AMPLIFIERS BUILT WITH AVALANCHE TRANSIT TIME DIODES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 12, Dec 84 (manuscript received after revision 16 May 84) pp 31-37

KOTSERZHINSKIY, B.A., and PARFENOV, A.A.

[Abstract] A practical realization of microwave amplifiers with negative resistance diodes, designed by using a parametric synthesis method causes some difficulties due to insufficient accuracy in manufacturing the



electrodynamic system and because of replacement of diodes. This requires either adding tuning elements, experimenting with prototypes, or a computer modeling. The latter is preferable, since it allows computation of the sensitivity of the output parameters to changes in the parameters of the system or the diodes, and adjustment of the amplifier. A system was developed for a computer aided design of reflecting amplifiers using diodes as the active elements and a waveguide electrodynamic system in the millimeter band. The computer mathematical model consists of equations describing the amplifier input characteristics as a function of the active elements parameters and the dimensions of the electrodynamic system. All programs were written in FORTRAN-4. With this software it is possible to analyze the amplifier operating in a linear or a nonlinear mode. The particular feature of the developed algorithms is that the system is capable of executing specific tasks. The computer aided design system was used for constructing a solid state reflecting amplifier in the millimeter waveband. This experience revealed the advantages of combining the algorithms used for the analysis and for the parametric synthesis in a unified system. This would make it possible to conduct experiments and to study the effects on individual elements of the electrodynamic system and on the synthesized amplifier output characteristics. By combining the analysis and the synthesis functions, and because of the feasibility of conducting computer aided studies, the developed system considerably increases the efficiency of designing the amplifiers. Figures 3; references 9: 8 Russian, 1 Western.  
[191-12755]

UDC 621.372.832.8

#### ENGINEERING COMPUTATIONS OF TWO-CHANNEL NONRECIPROCAL MICROSTRIP DIVIDERS-COMBINERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 27, No 12, Dec 84 (manuscript received 12 Aug 83) pp 22-25

VAMBERSKIY, M.V., USACHEV, V.P., and SHELUKHIN, S.A.

[Abstract] A circuit was developed for a microstrip nonreciprocal divider-combiner (NDC). The device consists of a disk ferrite resonator connected at a particular angle to the microstrip lines of specified width. Matrix analysis of the two-channel nonreciprocal divider-combiner and electrodynamic analysis of the microstrip line made it possible to obtain equations for the connection, and to select the ferrite parameters for non-reciprocal division or addition mode of the microwave power. From the NDC scattering matrix it follows that when the division coefficient or the ratio of the added powers is equal to infinity or zero, the NDC is converted to a Y or  $\omega$  circulator. Therefore, the analysis and the developed computation method is also applicable to circulators with non-symmetrical branches and different wave impedances of the connecting lines. Good agreement was obtained with the results of computations for non-symmetrical circulators using other methods. The usefulness of the proposed computation method was verified by

many experiments. A NDC, designed by the developed method for the centimeter wavelength range exhibited insertion losses not greater than 06-08 dB when a 10SCh6 ferrite was used for a unity division ratio. The decoupling between the input and the output branches was not smaller than 15dB in the (10-12%)band; the division irregularity was below 10% in the (6-8)% freq. band; and the decoupling between the output branches of the divider, as well as the adder, was at least 7-8 dB. Figures 4; references 5: 4 Russian, 1 Western.

[191-12755]

UDC 621.385.624

#### FLOATING -DRIFT KLYSTRON WITH ELECTRONIC EFFICIENCY OF ABOUT 90%

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 12, Dec 84 (manuscript received 23 Jan 84) pp 47-55

DOKOLIN, O.A., KUCHUGURNYY, V.I., LEBEDINSKIY, S.V., MALYKHIN, A.V. and PETROV, D.M.

[Abstract] A theoretical analysis was conducted based on experimental studies to determine the feasibility of achieving 90% efficiency of floating-drift klystrons. During the last 15 to 20 years klystron efficiency was gradually increased from 40-50% to 75-85%. This was possible by using the effect of the cavity generated microwave field on the electron flux at the signal frequency or its harmonics. As the electron efficiency approaches 90-95 percent, the range of the electron velocity distribution in the bunch formed at the cavity input is reduced, and for the case of perfect efficiency of 100%, the velocity distribution is governed by the conditions  $V_{out}(t_{out})=0$ . This is also the limiting condition in the equal velocity lines method for determining the parameters of the optimally extended bunch, which is the most advantageous configuration in terms of energy for the realization of the electron efficiency. Two-dimensional effects on the regulated bunching mode were examined. The relationship between the bunching parameters and the parameters of the output cavity were determined by the method of equal velocity lines and the critical conditions for minimal efficiency were derived. It was also pointed out that the high efficiency klystrons are very sensitive to changes in the parameters governing their operation, since a deviation can cause instability of operation. Realization of a concentrated bunching corresponds to a most advantageous mode and makes it possible to reduce the overall length of high-efficiency klystrons. Figures 8; references 12: 10 Russian, 2 Western.

[191-12755]

## AMPLIFICATION OF RANDOM SIGNALS WITH A TRAVELING WAVE TUBE

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 27, No 12, Dec 84 (manuscript received 28 May 84) pp 65-69

KARTAMYSHEV, V.M., and KATS, A.M.

[Abstract] Amplification of a random signal with a different spectral density in a TWT is determined by the frequency characteristics of the TWT, specifically by the dispersion of the retarding system, and the functional relationship between the coupling impedance and frequency. A complete analysis of the frequency characteristic can be made by a method based on a non-canonical representation of the random functions. With this method the particular features of the signal non-linear transformation can be examined. The advantage of the method is that a small number of the random values is needed for its realization and signal probability characteristics can be specified in a simple way. Good agreement between the correlation functions and satisfactory agreement between the spectral densities of the actual signal  $x(t)$  and its model offers a basis for assuming that the examined representation of the random signal is acceptable for the analysis of the amplification of the random signals in a O-type TWT. Since the O-type TWT parameters which are included in the system of non-linear equations depend on frequency, the particular form of this relationship is determined by the specific construction of the device. For an exact solution, experimentally obtained frequency response curves must be used. The degree of approximation obtained by the method for amplification analysis of wideband signals in devices whose parameters are weakly dependent on frequency must be further evaluated. Computations indicated that in the process of random signal amplification in a O-type TWT, a transformation takes place of the input signal spectral density whose degree is determined by input signal frequency bandwidth and power. Figures 2; references 7: Russian.

[191-12755]

## WIDEBAND MATCHING OF WAVEGUIDES CONTAINING MATERIALS WITH A LARGE DIELECTRIC CONSTANT

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 27, No 12, Dec 84 (manuscript received after revision 23 Dec 83) pp 70-72

KOSHEVAYA, S.V., and OMEL'YANENKO, M.Yu.

[Abstract] Materials with high dielectric constant  $\epsilon > 10$  are finding increasing application in distributed microwave structure. The use of these materials in hybrid-integrated substrates greatly expands circuit capacity. New prospects are offered for the development of amplifiers, detectors,

switches, etc by employing ferroelectric or piezoelectric materials with waveguides. The problem of matching a hollow waveguide with a partially filled waveguide (PFW) containing an isotropic dielectric wafer in E-plane was examined. Two-step or three-step discontinuities consisting of waveguide sections partially filled with different dielectric material were used for the matching. It was shown that the computation of an effective one-step transformer for a PFW with a strong dielectric can be made only by taking into account boundary diffraction. Wave diffraction was examined, a system of equations developed and the system was solved by a method of reduction. Theoretical and experimental frequency response curves were obtained for the reflections from partially filled waveguides with an optimized two-section transformer. For large values of  $\epsilon_{\text{eff}}$  optimization was required of the single-section, two-section, or three-section transformers, while for PFW with  $\epsilon_{\text{eff}} > 1,000$  satisfactory computations can be made of a three-section transformer with a single-wave approximation. Hybrid waves, whose critical frequencies are only slightly greater than the critical frequency of the fundamental are not excited in the examined transformer. Therefore, the operating range is limited by the critical frequency of the  $\text{LE}_{20}$  wave, and when the dielectrics are positioned at the waveguide center, by the  $\text{LE}_{30}$  wave. This was supported by the experimental tests of the field structure with a regular ferroelectric PFW. Figures 3; references 3: 2 Russian, 1 Western.

[191-12755]

UDC 621.372.837(088.8)

#### LOOP-TYPE MICROSTRIP SWITCH FOR SHF OPERATION

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 12, Dec 84 (manuscript received 06 March 84) pp 82-84

KUPTSOV, Ye. I., and LEBEDEV, I.B.

[Abstract] Solid-state microwave switches must satisfy diverse requirements including wideband operation, high speed and high power handling capacity. The incompatible nature of these requirements caused difficulties in designing integrated circuit devices, while the possibilities offered by some types of microwave filters are not fully utilized. Filters with a loop type construction were described in the literature. These filters are wideband and can provide good isolation; for example a microwave switch with a  $1.0 \lambda_B$  loop, where  $\lambda_B$  is the line wavelength. This switch exhibits good characteristics but the semiconductors in the circuit are subjected to high and irregular power in the cut-off mode. A loop-type switch with a  $3 \lambda_B/2$  loop is free of this deficiency. Performance and processes occurring in this device were examined and the typical operation characteristic curves were obtained. KA517A p-i-n diodes were used for the experimental prototype where the ratio of the auxiliary microcircuit loop characteristic impedance to the main loop was 0.8. With this ratio it was possible to obtain a wide cut-off band with a high isolation. In this case a band

whose width was greater than 35% of the central frequency at 20 dB level was obtained. In the passband mode with diodes at zero bias, the operating band was greater than an octave. This device can be used for designing regulated IC modulators, and switches capable of operating in a wide range of frequencies and a high microwave power at the input. Figures 3; references 4: 2 Russian, 2 Western.

/I91-12755/

UDC: 621.382

#### ANALYSIS OF GUNN OSCILLATOR SUBJECTED TO LOW-AMPLITUDE EXTERNAL OSCILLATION

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 28 May 84 after revision) pp 36-39

ALEKSEYEV, Yu.I.

/Abstract/ The differential equation for the microwave voltage developed at the terminals of a Gunn diode oscillator subjected to external periodic oscillation is solved with the help of oscillation theory. Computer analysis indicates that the sensitivity of the equivalent circuit increases as the conversion losses decrease, and approaches a maximum value that is governed by the internal noise level. The formulas derived for the basic parameters of the converter can be used for engineering analyses of similar devices. References 2 Russian.

/204-6900/

UDC: 621.372.831.1:621.372.853.3

#### INFLUENCE OF PLASMA ON CONDUCTIVITY OF STEPPED WAVEGUIDE JUNCTION

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 1, Jan 85 (manuscript received 28 Feb 84 after revision) pp 59-60

FISANOV, V.V.

/Abstract/ The occurrence of an active component in the susceptance of a junction formed by transversely magnetized ferrite and air in a rectangular waveguide, and when the ferrite is replaced by a magnetoactive plasma, is analyzed. It is found that the effect is not caused by gyrotropy of the medium alone, and can also occur when the waveguide is filled with an isotropic plasma. References 6: 4 Russian, 2 Western.

/204-6900/

UDC 681.325.5-181.48

MICROPROCESSOR CONTROL UNIT FOR PRODUCTION EQUIPMENT PROCESSING

Moscow AVTOMATIKA I TELEMEXHANIKA in Russian No 1, Jan 85 (manuscript received 13 Oct 85) pp 118-121

SKLYAROV, V.A., Minsk

[Abstract] This wide-spread approach to the design of a control unit for a production complex is based on the use of a microprocessor device (micro-electronic computer), program implementing computing operations and the logic of discrete control. The paper proposes the structure of such a device with distributed control. A block diagram of its is presented, the principles of operation are explained, and its advantages proved. Figures 1, references: 7 Russian.

## BROADCASTING, CONSUMER ELECTRONICS

### CONSUMER RADIOELECTRONICS AND EMC PROBLEMS

Moscow RADIO in Russian No 1, Jan 85 pp 14-15

KOMMIR VASIL'YEVICH IVANOV, candidate of engineering sciences, chief, State Telecommunications Inspectorate, USSR Ministry of Communications

[Abstract] The causes of interference that affects the use of consumer electronics, such as radio and television receivers, are discussed. It is found that most problems with consumer electronics stem from the fact that designers and customers often fail to take actual operating conditions into account and design or select equipment inappropriately. Overall solution of related problems is hindered by the lack of documentation regulating electronic equipment protection from external electromagnetic fields. Research is under way on the possibility of setting standards for the effect of electromagnetic fields on consumer electronic equipment. The role of radio amateurs in advancing this work is discussed.

[I96-6900]

### FOUR-BAND TRANSCEIVER BASED ON ELEKTRONIKA-KONTUR-80 KIT

Moscow RADIO in Russian No 1, Jan 85 pp 18-20

G. KASMININ, Moscow.

[Abstract] A voice/CW transceiver operating in the 160, 80, 40 and 20 meter bands based on the Elektronika-Kontur-80 kit and transceiver attachment discussed in an earlier article is described. The system provides sensitivity of 1 - 2  $\mu$ V, image channel selectivity of at least 50 dB and spurious radiation not exceeding -50 dB. The structural and schematic diagrams of the transceiver are presented and traced. The equipment employs the Elektronika-Kontur-80 main board, a crystal oscillator and two relays that switch the oscillator output circuit. The alignment procedures are explained in detail. Figures 4, tables 1.

[I96-6900]

## MULTIBAND DIRECTIONAL SHORTWAVE ANTENNA

Moscow RADIO in Russian No 1, Jan 85 pp 21-22

E. GUTKIN.

[Abstract] This article, the first of series, describes a rotating antenna system consisting of four separate antennas for the 47, 14, 21 and 28 MHz bands, all secured to the same crosspiece. The positioning of the elements serving the individual antennas so as to maintain all parameters (gain and protection) is discussed. Modeling of the antenna prior to construction is described. A three-band antenna for the 14, 21 and 28 MHz band that is the precursor of the 4-band version is described in detail. Figures 3, tables 2.

[I96-6900]

## MAGNETIC HEADS

Moscow RADIO in Russian No 1, Jan 85 pp 28-31

R. YASINAVICHYUS, Vil'nyus.

[Abstract] The fundamental processes occurring in magnetic record and playback heads in tape recorders are analyzed. The conversion of the magnetic flux of the medium to corresponding electrical signals is described. The nature and characteristics of different types of recording tape are discussed. The processes involved in tape magnetization and degaussing are explained. The requirements for magnetic materials employed in recorder heads are presented, and the parameters of selected heads and materials are tabulated. Figures 4, tables 3.

[I96-6900]

## BASIC FOR MIKRO-80

Moscow RADIO in Russian No 1, Jan 85 pp 33-36

G. ZELENKO, V. PANOV and S. POPOV.

[Abstract] A BASIC interpreter is presented that runs in 6.5 kbyte and, with minor modifications, makes it possible for the Mikro-80 microcomputer to run practically any BASIC programs, even those written for other computers. The interpreter requires at least twelve kbyte of RAM (starting at address 0000H). The interpreter is stored on tape and loaded to RAM by Monitor instruction 'I'. An example of a simple power calculation program is presented, which is to be discussed in detail in the next issue of the journal. Tables 2.

[I96-6900]



## GORIZONT Ts-257 LINE SCANNING MODULE

Moscow RADIO in Russian No 1, Jan 85 pp 37-40

Yu. KRUL' and V. KOSTELETSKIY, Minsk.

[Abstract] The MS-1 line scanning module employed in the Gorizont Ts-257 television receiver is described. This module generates line-frequency current for kinescope beam deflection, as well as a series of pulsed voltages for the convergence module, kinescope beam current limiting devices, automatic phase and frequency control, dimensional stabilization, etc. It also produces fixed voltages to power the anode, focusing and accelerating electrodes of the kinescope, the video amplifiers in the chrominance module and the voltage stabilizer in the control module. The basic technical specifications of the circuit are tabulated. The complete schematic diagram of the module is presented and traced, and samples of voltage waveforms taken at characteristic points are shown. Figures 2.

[196-6900]

## DIGITAL THERMOMETER

Moscow RADIO in Russian No 1, Jan 85 pp 47-49

N. KHOMENKOV and A. ZVEREV.

[Abstract] A digital thermometer is described that is designed for precise temperature measurement of various objects over a wide range, and is suitable for consumer as well as technical use. In contrast to similar devices described elsewhere, the present version employs a K572 series LSI circuit, and therefore contains relatively few components. The thermometer is ready to use as soon as the power is turned on; however, the unavailability of commercially produced sensors with small temperature inertia means that the measurement process is quite lengthy (about five minutes), which limits the area of application of the device somewhat. The basic terminal specifications of the thermometer and its schematic are presented. Circuit board foil pattern layouts are presented, and complete assembly instructions are provided. Figures 1.

## SENSORY CONTROL BOX

Moscow RADIO in Russian No 1, Jan 85 p 49.

I. NECHAYEV, Kursk.

[Abstract] This article describes a sensory remote control box for a toy tank driven by two electric motors. Rather than using mechanical switches to control the power going to the motors, sensory contacts are used that make

it possible to change the speed of the toy. This is achieved by powering the motors with pulsating current. The average current passing through the motors, and consequently the motor speed, is changed by changing the relative pulse duration. The schematic diagram of the circuit that accomplishes this is traced and explained, and the circuit board foil pattern is presented. Sensory contacts are shown that consist of a foil-covered textolite board with grooves in it that form small areas that are insulated from one another. The contacts are configured so that the toy can be controlled with one or two fingers.

/I96-6900/

#### MODERNIZATION OF YUNOST' KP101 RADIO RECEIVER

Moscow RADIO in Russian No 1, Jan 85 pp 53-54

V. KUZNETSOV, Moscow.

/Abstract/ A modification is proposed for the Yunost' KP101 receiver described in a previous article that makes it possible, using the same kit parts, to build a receiver that is easier to align than the original model and that eliminates the self-oscillation observed previously. The modification is based on a direct-gain receiver in which the variable capacitor is shielded, a U-filter is used in the detector and a capacitor is added to provide RF shunting of the power to the input stages. The schematic diagram, board foil pattern and component placements are shown. Figures 3, references 2 Russian.

/I96-6900/

#### CW OPERATION

Moscow RADIO in Russian No 1, Jan 85 pp 55-56

B. STEPANOV

/Abstract/ This article is the first in a series providing an introduction to CW working for new radio amateurs. The bands allocated for CW working in the USSR and around the world are explained. The use of CQ calls to establish contact is discussed. An example of a QSO is presented. The maintenance of station logs is explained.

/I96-6900/

## REALIZATION OF POLYHARMONIC REGIME ON MEDIUM WAVE TRANSMITTERS

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 85 (manuscript received 21 Feb 84)  
pp 57-59

PROSHUTIN, N.V.

[Abstract] The circuit of an output oscillatory system for realization of a polyharmonic regime is tested on an operating transmitter with a power of 1000 kW with various relations of the levels and phase of the harmonics. The practical results correspond with calculated data on the electronic efficiency factors. Figures 2; tables 1.

## WIDEBAND POWER AMPLIFIER

Moscow RADIO in Russian No 12, Dec 85 pp 18-19

B. ANDRYUSHCHENKO, Khar'kov

[Abstract] A FET power amplifier providing output power of about 70 W into a 75 Ohm load and gain of about 40dB in the middle of the 3 - 30 MHz band is described. The schematic diagram of the device, and its amplitude-frequency characteristic, are shown. The design of the wideband transformer employed in the amplifiers tested by the author is described. The amplifier is found to be stable with various loads, including tuned and 'random' antennas, such as a piece of wire 2.5 meters long. References 4: 2 Russian, 2 Western.

[205-6900]

## VOLTAGE INDICATOR LAMPS

Moscow RADIO in Russian No 12, Dec 85 pp 25-26

V. KOROBAYNIKOV, Izhevsk; S. KULAKOV, Moscow; and A. BELOUSOV, Sumgait.

[Abstract] This article describes voltage indicator lamps - 'idiot lights' - for 12-volt motor vehicle systems. The devices are easy to build, and can be used in a number of devices, including battery-powered radio receivers, tape recorders, etc. The first indicator described incorporates an active digital microcircuit inverter in its threshold element; the accuracy of this device can be improved by connecting several inverters in series and employing a minimum limiter in the input circuit. A second device is described that incorporates an LED voltage indicator. A third device is presented that incorporates only a single LED. Schematic diagrams of all three indicators are presented, and their operating principles are explained.

[205-6900]

## GORIZONT Ts-257 CONTROL SYSTEM

Moscow RADIO in Russian No 12, Dec 85 pp 27-29

G. MAZURKEVICH and L. SHEPOTKOVSKIY, Minsk.

[Abstract] This is the second of a series of articles on the Gorizont Ts-257 television receiver, and describes the control system, which consists of an SVP-4-10 sensory channel selector and a BU-1 control module. The channel selector selects any of six pre-set channels in the meter of decimeter band when the corresponding button on the set is presented. A corresponding channel indicator lights up when a channel is selected. Schematic diagrams of the channel selector, the channel switch and the control module are presented and explained.

[205-6900]

## CONNECTION OF VIDEOCASSETTE RECORDERS TO UPIMTS-61/67-II TELEVISION SETS

Moscow RADIO in Russian No 12, Dec 85 pp 30-31

I. MAL'TSEV and Yu. ROMODIN, Moscow.

[Abstract] This article describes the USTsT-2 interface device that is incorporated in different brands of USSR-produced video-cassette recorders to allow them to be connected to type ULPTsT color televisions. Modifications to the interface device to permit connection to UPIMTsT televisions are described. The schematic diagram of the interface device, which matches the input and output impedances and signal levels of the sets being connected, are presented and explained. The modification of the device, which entails the removal of a jack and a number of resistors and capacitors, which are replaced with diodes and jumpers is outlined. Connection of the modified device to the television set is explained.

[205-6900]

## INFRARED REMOTE TV CHANNEL CHANGER

Moscow RADIO in Russian No 12, Dec 85 pp 31-32

Ye. LARKIN, L'vov.

[Abstract] An infrared remote control unit that works with televisions employing the SVP-4 sensory channel selector, such as the Gorizont-728, the Elektron-718 and Vityaz'-722, and Ts200-series sets, is described. The device, which works from up to five meters away, is made of a self-contained IR transmitter, and a receiver that is built into the television. The schematic diagrams of the transmitting and receiving units are presented and explained. The board foil pattern layouts and component placement are shown. The transmitter is powered by four 316-series elements.

[205-6900]

## INFRARED TELEPHONE

Moscow RADIO in Russian No 12, Dec 85 pp 33-36

V. POLYAKOV, Moscow.

[Abstract] This article describes a simple infrared telephone system that can operate over ranges as great as several kilometers and can be built by relatively inexperienced amateurs. The theory of IR communications is discussed briefly. A transmitting and receiving system is described that incorporates an AL107 IR light emitting diode for transmitting as well as receiving. The schematic diagram of the device is presented and explained. Step-by-step assembly instructions are given, and adjustment of the finished system is described. Daytime range of several hundred meters can be achieved, and nighttime operation is possible over ranges of up to 1.5 km.  
[205-6900]

## FOUR-CHANNEL SENSORY SWITCH

Moscow RADIO in Russian No 12, Dec 85 pp 41-42

V. MATYUKHIN, Voznesensk.

[Abstract] A sensory switch analogous to a push-button switch with adjustable limits is described. The parameters of the switch permit it to be used in high performance consumer radio equipment. The device consists of a control assembly and an electronic switch. The sensors work by using the emf induced by the ac line on the body of the operator. The schematic diagram of the switch is presented and traced.  
[205-6900]

## HIGH PERFORMANCE POWER AMPLIFIER

Moscow RADIO in Russian No 12, Dec 85 pp 44-46

Yu. SOLNTSEV.

[Abstract] This article provides answers to questions submitted by readers regarding a high performance power amplifier described in an earlier issue. The following issues are dealt with: the type of power supply employed, the design of the inductance coils, the provisions for heat removal, substitute transistors, operational amplifiers, relays and LEDs that can be used, how to increase the nominal input voltage to 0.7 - 1 V, the use of an 8-Ohm load, and whether a different power supply can be used. The schematic diagram and board layout of the amplifier are presented.  
[205-6900]

## CIRCUITRY OF JAPANESE CASSETTE TAPE RECORDERS

Moscow RADIO in Russian No 12, Dec 85 pp 46-51

N. SUKHOV, Kiev.

/Abstract/ This article describes the circuit treatments employed in the basic functional assemblies of cassette recorders produced by leading Japanese firms. The playback amplifiers employed in the Sony TS-K75, the Nakamichi N-670ZX and the Aiwa AD-F80 recorders are presented. The record amplifiers, level indicators and erase oscillators are also described.  
/205-6900/

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